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DIVERTICULITIS OF THE COLON, WITH ESPECIAL ATTENTION TO THE DIAGNOSIS

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DIVERTICULITIS of the large bowel is of interest to the surgeon because of its ability to simulate other inflammatory conditions in the abdomen, including appendicitis, cholecystitis and acute pelvic inflammatory disease, as well as on account of its not infrequent demand for operative relief or radical cure. It is of interest to the internist because it requires to be differentiated from other causes of vague chronic or recurrent abdominal distress, and because it responds well, in its less acute phases, to medical treatment. It is, however, of even more interest to the roentgenologist, since only he is capable of making a definite diagnosis of this condition in the living patient and since this diagnosis often gives an unexpected and thoroughly satisfying solution to what may have been a puzzling clinical problem. In the recognition of this disease, as in other phases of abdominal X-ray diagnosis, the profession owes a considerable debt to Carman, who was the first roentgenologist to report a series of cases examined by the roentgen ray and the first to formulate a scheme for the recognition and differential diagnosis of diverticulosis.

This condition was described from the pathological standpoint by Graser in 1899. In 1907, Mayo, Wilson and Giffin reported five cases which had been treated surgically. The first reported case examined by X-ray was one described by Abbe and examined roentgenologically by LeWald, reported in 1915.

Carman's first report was published in 1915 and detailed three cases examined at the Mayo Clinic by X-ray. In the first two of these cases the condition was not recognized from the X-ray films, as Carman had concluded after examination of pathological specimens that it would be impossible to demonstrate diverticula by means of an opaque enema or meal. The characteristic shadows were, however, noted on the films and when the cases subsequently came to operation an extensive multiple diverticulosis was found in both patients. Carman promptly concluded that the small round extraluminal shadows noted must have been due to filled diverticula. The third case of this series had not come to operation at the time of the report, but showed perfectly typical shadows. Since that report, roentgenologists have been finding diverticulosis in an increasing percentage of patients undergoing routine gastro-intestinal examinations, as well as in patients having suggestive symptoms. Case estimates that one in eighty of his routine gastro-intestinal examinations shows diverticula, and our own records show at least as common an incidence as this. As with other more or less rare pathological conditions, the worker who is most zealous in the search for diverticulosis and most open to suggestions of its presence encounters it most frequently.

True and false, acquired and congenital, diverticula are described in the literature. As a matter of fact, however, the colonic

diverticula of clinical importance are always false, and acquired; that is, they involve only the mucosa and the serosa, the former being herniated through an opening in the muscularis. Thus, the diverticulum in its simple form consists of a small sac, varying from the size of a wheat grain to that of a hen's egg, lined with mucous membrane and covered with peritoneum. There is more or less inflammatory thickening due to round-cell infiltration between the two layers, and adhesive peritonitis outside the diverticulum in diverticula which have suffered repeated attacks of sub-acute inflammation. This thickening may become extreme and cause a large, easily palpable mass which, in turn, may become so extensive as to mask the true condition and lead to an operative diagnosis of carcinoma, as was often the case before the condition was as generally recognized as it is to-day. There is ordinarily no ulceration of the lining of the diverticulum, a fact which explains the usual absence of blood from the stools. The sac is often filled with fecal matter or sometimes is occupied by a fecolith. It is probable that putrefactive changes in the imprisoned contents set up the irritation and inflammatory reaction which result in acute diverticulitis. Pressure of the contents on the sac wall may also be a factor and may lead to perforation. This, in turn, is apt to be followed by general peritonitis or, under different conditions, by the formation of fistulae communicating with the bladder or opening through the skin. These old cases are of surgical interest and offer very complicated operative problems for their relief.

By far the most frequently involved part of the bowel is the sigmoid. In an operative series of forty-two cases, reported by W. J. Mayo, the sigmoid was involved in thirty-six, the right colon in three, and the rectum and recto-sigmoid region in three. It should not, however, be lost sight of that diverticula may and do occur in the transverse colon, the ascending colon and even

in the cecum, and the roentgenologist, particularly, should be on the lookout for diverticula in these less frequently involved parts of the colon as well as in the sigmoid. Usually the herniations take place either on the mesenteric or anti-mesenteric border, a fact which renders their recognition on X-ray examination the more likely. They may, however, occur in other positions. No theory as to their causation is entirely satisfactory or well sustained. It has been suggested that the original herniation takes place through the channel occupied by a blood vessel. It seems likely, reasoning from the typical history, that repeated straining at stool has something to do with the initiation of the process. However, we have re-examined individual cases at intervals of two, three or four years and have been able to detect no change in the size of the diverticula demonstrated and no new diverticula formed during the interval, and however valid this explanation may seem to be with regard to diverticula in the extreme lower bowel, it would not seem to have very much force in the explanation of lesions occurring, for instance, in the cecum.

The symptoms of diverticula are varying in degree and depend entirely or almost entirely on the amount and character of inflammatory reaction about the sacs. The word "diverticulosis" is used advisedly to denote a condition in which one or many symptomless and uninflamed diverticula exist. This class includes many or most of the cases discovered as an incidental finding during a routine X-ray examination of the gastro-intestinal tract. Diverticulitis, on the other hand, includes all of the cases of diverticulosis which are in a state of inflammatory reaction and, thus, practically all which give symptoms. The typical subject of a diverticulitis is a male over the age of forty, considerably over-weight and subject to chronic constipation; one might say the male counterpart of Deaver's famous typical gall-bladder patient. The proportion of

males to females is about as two to one, or perhaps a little greater than this. While Erdmann and others have reported cases in children (Erdmann, one case, aged six), by far the greater majority of these patients are forty or over. As intimated, almost all of them give a history of chronic and more than ordinarily severe constipation. Other facts in the history are apparently not of general importance. There seems to be no tendency to association with hemorrhoids, no family tendency, and no association with other diseases.

The mildest recognizable symptoms consist of rather vague and intermittent pains, perhaps occasionally cramplike in character, in the left lower abdomen, associated with a tender, palpable, rope-like sigmoid. The latter physical finding will, of course, be difficult or impossible to bring out if the abdominal wall is extremely thick. Accompanying the pain there may be bladder symptoms, as occasional attacks of frequency and tenesmus. Such a history given by a patient of the age and build described should by its very vagueness and failure to conform to the type of the better known and more commonly recognized abdominal disturbances, suggest that diverticulitis ought to be eliminated as a possible cause.

On a slightly more severe order are the more definitely inflammatory reactions giving rise to a palpable mass in the left lower quadrant, which may decrease markedly in size and tenderness after an exacerbation of all of the symptoms described above. These exacerbations may occur at intervals of weeks, months or even a few years, and between whiles the patient is apt to have more or less vague discomfort and possibly mild bladder symptoms.

The attack itself has often been described as simulating a left-sided appendicitis. Many patients, however, have inflammatory disturbances which do not reach this grade of severity. The definite and typical attack is apt to be ushered in by rather severe pain

in the left lower abdomen, more or less rigidity in the muscles of the abdominal wall, and nausea and vomiting. There is fever, usually not high, and an increase in the white blood count, comparable to that oc-



Fig. 1. Twenty-four hours after meal and immediately after enema. This colon shows diverticula on the upper border of the transverse colon, a mass peristaltic movement obliterating the colon between the hepatic flexure and the middle of the transverse colon, dilated cecum with incompetent ileocecal valve, and, very typically, the saw-tooth spastic sigmoid and descending colon so often associated with diverticulitis.

curring in appendicitis. This attack lasts from a few hours to two or three days and may terminate by lysis and gradual subsidence of symptoms, or may go on, if unrecognized and untreated, to one of the complications—abscess formation, general peritonitis or the formation of a fistula opening into the bladder or through the skin.

Through the formation of massive inflammatory deposits angulating or obstructing the bowel, diverticulitis is capable of causing acute obstruction which may demand immediate operative relief. W. J. Mayo points out that in these cases the condition seen within the abdomen may simulate very close-

ly an advanced carcinoma, even to the point of enlargement and apparently malignant involvement of the glands, due, however, in this case to the inflammatory condition alone.



Fig. 2. Twenty-four hours after meal and immediately after enema. The colon shows numerous large and small diverticula arising from the sigmoid. Note also the dilated rectal pouch and the irregularly filled appendix.

There is, however, a definite and important group of cases in which carcinoma is apparently implanted on old diverticulosis. Wilson comments on the importance of this sequence and explains it by suggesting that the malignant degeneration is initiated by the cutting off of masses of epithelial tissue by the inflammatory process. Erdmann emphasizes the possible rôle of irritation through putrefaction of the sac contents in starting the malignant change. In Mayo's series of forty-three operative cases, thirteen had cancer. Thus, from the surgical aspect there is an apparent double possibility of confusion: first, in mistaking an inflammatory mass for a carcinoma and, second, in overlooking the possibility of malignant degeneration

of a previously simple diverticulitis. The diagnosis of the acute attack of diverticulitis is a matter for the surgeon and depends upon the existence of the typical attack, already described, plus the information



Fig. 3. The same case as shown in Figure 2, twenty-four hours later, showing additional diverticula filled in the interim.

obtained from the history, unless there is available the report of a previous X-ray examination, which disclosed the condition in the quiescent stage. Except in the acute attack, the diagnosis depends on the X-ray examination for finality, as the history is at best only very suggestive. Characteristic and conclusive physical signs are wanting. The condition can rarely, if ever, be recognized through the sigmoidoscope, and definite laboratory evidence is not obtainable. Ordinarily the stool does not differ from that of the average constipated individual. Blood is very rare and mucus quite unusual.

Actinomycosis and tuberculosis have been mentioned as conditions possibly requiring to be differentiated from chronic divertic-

ulitis. In either event, a stool examination should furnish the necessary evidence.

No description of the technic of the routine gastro-intestinal X-ray examination will be given. A few points of special technic

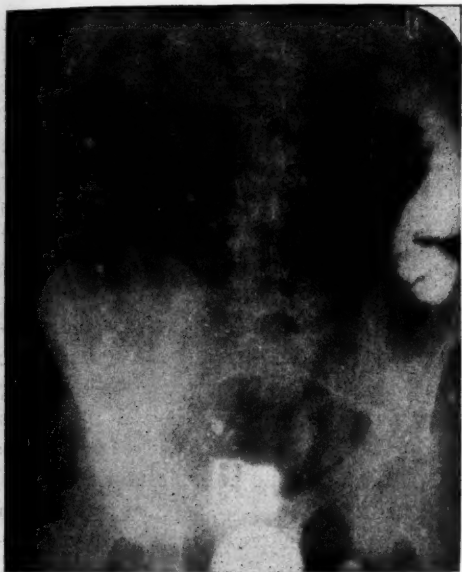


Fig. 4. Forty-eight hours after a meal, showing a residue in the cecum and numerous filled diverticula along the transverse and descending colons and sigmoid. This case has been under observation for four years and shows no demonstrable change on repeated examinations.

which are apt to aid in the discovery of suspected diverticula will, however, be mentioned.

It is not only good routine in regular gastro-intestinal diagnosis but it is particularly desirable in cases of suspected diverticulosis to make a preliminary film of the entire abdomen over the Bucky diaphragm in the antero-posterior projection. This film serves to establish the presence or absence of abnormal densities which might later in the examination happen to be so placed in relation to the colon as to simulate filled diverticula. Among possible causes of such densities should be mentioned single dense gallstones, atypical kidney or ureteral stones, calcified glands and phleboliths.



Fig. 5. Shows a single diverticulum at the hepatic flexure. This case has repeated attacks closely simulating acute cholecystitis, presumably due to diverticulitis.

A barium meal is then given and such examination of the stomach and upper intestinal tract as seems called for is made. We have not found that one type of meal is any more apt to fill diverticula than another, although George and Leonard mention a preference for a buttermilk meal. Examination of the colon begins twenty-four hours after the administration of the meal and may be terminated at this time by the administration of a barium enema, or administration of the enema may be delayed until the second or third day, depending on the state of filling of the diverticula and the rapidity with which the filled ones seem to be emptying, and also, and perhaps chiefly, upon the rate of passage of the main body of the meal through the lumen of the bowel. At any rate, the residue from the meal should be examined both by fluoroscope and film before the administration of the enema.

Occasionally no suspicion of the presence of diverticula will be excited until the enema is administered at the twenty-four hour ex-

amination, as a part of the gastro-intestinal routine. There may be no filled diverticula, but only an appearance in the sigmoid which suggests that they may be present, in which event the examination should be carried further, probably by the administration of a second meal and careful re-examination of the colon twenty-four, forty-eight, and seventy-two hours afterward. The characteristic appearance of the bowel which should excite suspicion as to possible diverticula is what has been described as the "saw-tooth sigmoid." This appearance is probably chiefly due to spasticity and perhaps partly to actual and permanent deformity from the thickening of the bowel wall. At any rate, it is highly suggestive and will not be overlooked if one has seen it a time or two. In such cases, one is apt to find filled diverticula on re-examination.

The ideal sequence which we have established in our own work for the unqualified diagnosis of diverticulosis consists in, first, a negative preliminary film or one showing abnormal densities which can be clearly identified for what they are; second, the presence of filled diverticula following the meal either at twenty-four, forty-eight or seventy-two hours; third, the demonstration of these filled diverticula as extraluminal shadows after the barium enema, and, fourth, the persistence of filled diverticula after the bowel has emptied of barium. It has been suggested that it would be desirable to use an enema of less barium content than the meal in order to permit showing by contrast filled diverticula which do not happen to lie on either border of the colon. In our experience this has been unnecessary, as at some time during the examination these filled diverticula will show through the bowel as sharply outlined areas of heavily increased density.

From the roentgenological standpoint, perhaps the only condition which is apt to be confusing and which requires differential consideration, is cancer. The X-ray char-

acteristic of cancer of the colon is, of course, an irregular, ragged filling defect which may involve only part of the wall or may be annular in character, and which is apt to produce more or less narrowing of the lumen of the gut. Discrete, sharply outlined, extraluminal shadows are no part of this picture. Therefore, no confusion is apt to arise between uncomplicated cancer of the bowel and uncomplicated diverticulosis. The difficulty arises when one is trying to determine whether narrowing in a colon showing diverticulosis is due to the benign process alone or to an engrafted malignancy. In my opinion, it is in the early case quite impossible to determine this from the roentgen-ray examination alone. Later in the course of the malignancy, when the filling defect becomes extensive and typical, its recognition should be fairly easy if one bears in mind the possible co-existence of the two conditions. We have two cases in our series which certainly developed carcinoma long after the diagnosis of diverticulitis had been made, and in both of these cases we were somewhat delayed in making the final discovery of the malignancy through knowledge of the previous existence and benign course for several years of the diverticulosis. This is a mental hazard which the examiner must learn to overcome.

Another interesting phase in differential diagnosis is the often overlooked possibility of a right-sided diverticulum causing attacks closely similar to acute cholecystitis. One of the illustrations with this article shows such a case. This patient had had three attacks of severe pain and rigidity in the upper right quadrant, accompanied by fever, leukocytosis and nausea and vomiting, in which a clinical diagnosis of acute cholecystitis had been made by two competent internists. The condition was not severe enough to warrant operation and our later finding of the diverticulum on the hepatic flexure at the exact site of the ten-

derness, together with entirely negative findings as regards the gall bladder, seems to offer an adequate explanation. Similarly, diverticula on the sigmoid have caused attacks closely resembling appendicitis.

The treatment of acute diverticulitis with abscess formation or with any of the late complications is, of course, chiefly surgical and may involve simply the drainage of the abscess and dissection or closure of fistulous tracts or possibly resection of more or less extensive segments of the colon. The series of cases operated upon, as reported by Mayo, was of this latter character and showed an operative mortality of only 14 per cent, in spite of the fact that many of these cases were operated on under conditions far from ideal, due to marked obesity, the presence of infection, etc.

The medical treatment of the less severe forms has received far less attention, and it seems that it should be more strongly emphasized than it has been. Dudley Roberts calls attention to certain measures which have been successful in his hands, namely (1), the avoidance of severe laxatives; (2) large weekly or bi-weekly doses of bismuth or barium; (3) the injection of solutions of gelatin, 10 per cent, administered at a temperature of 120° F.; (4) the use of antispasmodics, of which the most successful has been luminal, one-third grain three times daily.

We have observed a number of such cases under medical treatment and have seen marked palliation of the symptoms, often amounting to complete relief, follow some of these measures. The most important, perhaps, is the injunction as to the avoidance of purgatives. It is, on the other hand, necessary to maintain intestinal drainage. Frequent small doses of mineral oil, with or without agar, seem ideal for this purpose. The administration of the ordinary barium sulphate, such as is used for X-ray diagnosis, was suggested to us independently through the fact that so many of these pa-

tients reported relief from symptoms for a period of a few days after X-ray examination. We then suggested the administration every three or four days of an ounce of barium mixed with buttermilk. We have had some experience with the use of luminal, which seems to relieve the spasm in a considerable proportion of cases. Its action is apparently somewhat erratic, being highly satisfactory in some patients and quite unsatisfactory in others. Hanes has suggested and used alternating enemas of small amounts of argyrol solution, 2 per cent, and potassium permanganate solution. These solutions are administered hot and in the amount of eight or ten ounces, as it is necessary in the usual case involving the sigmoid to fill only the distal part of the bowel. Probably diet is also a factor and it would seem that the ideal diet should be one that would leave a considerable soft residue in the bowel, that is, one containing large amounts of vegetables of the coarse variety. From our experience, we certainly should not advise any wholesale resection of the bowel, except in the presence of urgent symptoms.

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THE ROENTGEN TREATMENT OF LEUKEMIAS¹

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BY leukemia is meant a condition in which there is extensive proliferation of the leukopoietic tissues of the body, either lymphadenoid or myeloid, with the appearance in the blood of white blood cells not normally present. There is, usually, an increase in the number of white cells; this, however, is not the absolute rule.

In 1845, Virchow recognized the leukemic states at the autopsy table: shortly afterward Vogel recognized the disease during life. Since the work of these pioneers our ideas of the leukemias have undergone remarkable development. During the past years we have learned to distinguish between leukocytosis and leukemia. This differentiation has not been made on the number of white cells present, as there are often cases with a leukocytosis of 100,000 white cells per c.mm. and leukemias showing only 50,000 white cells. The usual leukemia as a rule shows a white count far in excess of 50,000. Another important step in the diagnosis of leukemia was the recognition of the qualitative deviations in the white cells, which was of far greater aid in differentiation than the quantitative changes in the total count. Ehrlich, by means of specially stained smears, introduced the differential blood count, which was an important factor in diagnosing these difficult blood diseases. It was soon found that in certain cases of leukemia the lymphoid cells predominated, while in others the myeloid cells were more common. Following this discovery it was thought for a time that the presence of myelocytes was absolute evidence of leukemia; later on, the non-leukemic myelocytes of bone marrow carcinosis and anemia pseudoleukemica infantum were recognized. Through clinical and autopsy studies, it has

been demonstrated that proliferation of either the lymphoid or myeloid tissues similar to those that occur in the leukemias may take place without the appearance of immature cells in the blood. In the majority of cases, a diagnosis can be made from the differential count of the white cells alone; in some cases, however, the blood picture in itself is insufficient for a diagnosis. In arriving at a diagnosis no one method or sign should be depended upon as conclusive. Each patient should be studied by all available methods before drawing our final conclusion.

It was thought by some, on account of the enlarged spleen in some cases of leukemia, that leukemia is splenogenous in origin; this we know is not true and that the leukemias are divided into two main groups, namely, those of lymphadenoid origin and those of myeloid origin. Leukemia is not a disease of any one organ, but a condition that is widespread throughout the body. In certain patients, the disease may attack the lymphadenoid tissues all through the body, while in others the disease may show a predilection for the myeloid tissues of the marrow of the various bones of the body.

Through the study of the blood we are able to determine what tissues of the body are involved in the disease; in other words, whether there is a proliferation of the lymphadenoid or of the myeloid tissue. The changes in the blood are not primary; it is through the stimulation of the different kinds of leukopoietic tissue that the various types and changes in the blood cells occur. In the early cases of lymphadenoid or myeloid leukemias the aleukemic lymphadenosis and the aleukemic myelosis may precede the blood changes.

Leukemia is a comparatively uncommon disease, slightly more frequent in men than

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in women. We are seeing more cases lately, due rather to the better means of diagnosis than to its increase in frequency. In the average hospital practice the disease is relatively rare—about two cases per thousand admissions. The disease is usually chronic and occurs most often during middle life. In young adults and children it is the acute form of the disease that is usually encountered. It occurs in all parts of the world and affects animals as well as human beings; the horse, cow, and dog are often affected.

Very little is known about the etiology of the disease although some writers favor the infectious origin. Barker, in his work on leukemia, is struck with the possibility of infection playing a part. He describes a case to substantiate his belief.

The differentiation of chronic lymphadenoid and chronic myeloid leukemia is comparatively easy from the blood picture. To distinguish the acute form of lymphadenoid leukemia from the acute form of myeloid leukemia calls for a great deal of study and is exceedingly difficult. In the examination of the blood in acute leukemias it is impossible for the average physician to differentiate the various types of cells; in fact, a skilled hematologist may, under ordinary conditions, be unable to distinguish the cells. The differential diagnosis is of very little importance from a practical standpoint, as the diseases run about the same rapid course and do not respond to any form of treatment.

In recent years we have seen a number of cases simulating lymphatic leukemia, even to the lymphocytosis. These cases have been quite acute. The cervical and axillary lymph glands become greatly enlarged and are tender on palpation. There is also great enlargement of the mediastinal glands. Accompanying the adenitis there is a marked leukocytosis, with a great increase in the lymphocytes. These cases usually subside in a couple of weeks but are apt to recur at a later date, running practically the same

course. They have been scrutinized very closely with the thought of infection as the cause of the blood changes and enlarged glands. One of the patients had his tonsils removed and obtained prompt relief for a time. Some time later the glands again enlarged. His physician then advised him to go to the seashore for a rest. The instructions were followed, and after remaining East for six weeks he returned, and has had no further trouble. Another patient, white, female, aged 27, showing practically the same symptoms objectively and subjectively, gradually improved under rest in the country. At present she is apparently cured. On radiographic examination, the posterior mediastinum shows enlargement of the lymph glands, which decrease in size with the other glands. All these cases are comparatively recent and it will be interesting to see whether they develop any further trouble. It may be that this is only the beginning of a leukemia which has periods of exacerbation and remission.

We will now consider the roentgen treatment of chronic leukemias. I specify the chronic, as it is not wise to attempt the treatment of the acute types. In passing, I might mention one case that is illustrative of an acute leukemia. The patient, a white female, about fifteen years of age, came to the hospital suffering from severe pain in the abdomen. There was some swelling of the cervical lymph glands, which were very tender on palpation. The gums were spongy and bled quite freely. Small hemorrhages were present under the skin of the extremities. During the course of the disease, which was about ten days, the patient ran a temperature of 103° . The ends of the long bones were very tender on palpation. The patient was referred to the roentgen department for therapy. In our opinion it was unwise to treat her, and we informed her physician to that effect. He wired East to one of our very eminent hematologists, who advised small doses of X-rays to be

given over the ends of the long bones. The patient was brought to the department on a stretcher and a very small dose of X-ray was given over the right knee. There was no change in the patient's condition and in a few days she died.

In the treatment of the chronic leukemias, the results have been very good, considering not a cure but an amelioration of symptoms, making it possible for the patient to carry on his or her daily duties. I am not sure that there is an actual increase in the years under X-ray treatment; there is, however, a great increase in the number of working days. I am sure that if you take two cases as near alike as possible and put one on the ordinary medical care and one on careful roentgen therapy, the latter will be able to carry on much better and will have more days free from pain than the one on medical treatment. Considering only the financial part of the question, the results will favor the X-rays. A man who can work along and take treatment can take care of his family much better than a man who is ailing. If the rays do nothing more than produce a temporary feeling of well being, they are certainly worth trying.

In the treatment of these poor unfortunates, a good deal depends upon how, when, and where they are treated; to treat these patients at random is worse than not to treat at all. To treat such a patient over the spleen because some one else did, or because the doctor ordered it, is also far from correct. Before treating any type of chronic leukemia, insist on seeing the blood count, taken not later than the day before your treatment; study the count and try to determine in your own mind what tissues are suffering, and where the proliferation is taking place that causes the various types of abnormal blood cells. When the patient is brought to the roentgen department, go over him carefully, also delve into his history. Be sure to ascertain whether the patient has had any previous X-ray treatment. In

looking over the patient you can in a way decide upon the line of treatment to be followed. If the glands are greatly enlarged, it may be necessary to apply some radiation over these areas. It has been our experience, however, that these glands will become smaller and unusually disappear, whether treated directly or not. It is not uncommon to find glands in the neck decrease in size while one is treating the long bones of the legs; this is not unlike the changes that occur in Hodgkin's disease.

In the treatment of all our cases we have ascribed little importance to the direct treatment of the spleen; rarely do we treat it directly. In the usual manner of treatment the spleen seems to diminish in size; this is especially true when the chest is treated. If a great deal of radiation is directed at the spleen in the old cross-fire method, the spleen becomes hard and, for a time, small. If carried on for a long period this will result in a great increase of connective tissue in the spleen; later the spleen becomes larger than it has ever been and the blood count (white) remains very low. Small doses of radiation have no effect upon the size of the spleen and larger doses are contra-indicated, due to the low count. If the spleen had not been directly radiated and no scarring had occurred, it would certainly be more responsive at this time—the most important time—as these patients usually die. A large soft spleen is a great deal easier to handle than a large fibrotic one; I would much prefer a great large soft spleen to a large hard one; the hard spleen is very difficult to deal with in any size.

From past experience—which covers some thirty cases of leukemia—we have adopted the following method of treatment: First, recently made, complete blood count. The first treatment is made over the anterior chest, trying to avoid the spleen. The dose is usually as follows: 200,000 volts, $\frac{3}{4}$ mm. of copper plus 1 mm. of aluminum, 50 cm. skin distance, 5 ma., for about twenty

minutes. There is, as a rule, very little discomfort following the treatment. The patient remains in bed and blood counts are made daily. The count usually goes down the second day. The daily count records the progress; as long as the count continues to go down no further treatment is given. If the count fails to diminish, the treatment is repeated. When the count starts to increase, the treatment is continued, the blood counts again made, and the same procedure followed. After three or four treatments, the patient is sent home and told to return to the hospital one day each week for a blood count. In this way we keep in close contact with him and can treat him whenever we deem it necessary.

Accompanying the diminution of the white cells, there is a concomitant improvement in the general health; the patient feels very well. The other constituents of the blood also show some improvement. I will later report a case that showed a definite increase in the reds and in hemoglobin, and, while the white count showed practically no pathological cells, the reds increased from 2,000,000 to 4,500,000 and the hemoglobin from 75 to 98 per cent.

The reason for the marked improvement when treating over the chest, I have not been able to explain to my own satisfaction; I do not believe that it is due to action of the rays on the lymphatics as there is a great deal more lymphoid tissue in the abdomen than in the chest. I know that the results are better and the reaction less severe in cases treated over the chest than over the abdomen. Patients have been treated over the abdomen and the count shown practically no change; the treatment was then directed over the chest and immediate improvement followed. Probably the best explanation of why the results are better lies in the large amount of marrow in the vertebrae, ribs and sternum, and also the large

amount of blood in the chest may account for the prompt decrease in the blood count after radiation.

RESULTS

At present we have one patient, a man, whom we have treated for seven years; his count remains around normal. About once a year he is required to take a few treatments. During these seven years he has been able to continue his work and has felt very comfortable. This patient has lived longer with this disease than any one of whom we know. Most of the patients are greatly improved for a year or so and then they start to decline. If they have had an excessive amount of radiation, they respond poorly during future treatments. For this reason we do not make a practice of extensive radiation.

The average length of life after the disease is established, when treated by X-rays, is about one year. When the end is approaching the white count falls to around 15,000, and treatment seems to aggravate rather than help. I believe it is important, in treating these patients in the early stage of the disease, not to try to reduce the whites to normal, but to find a place where the patients feel comfortable and try to keep the blood count at that point. A great many patients feel very well with a count around 50,000.

REPORT OF CASE OF MYELOGENOUS LEUKEMIA

White, male, aged 20, was referred to our department by Dr. J. L. Miller, October 9, 1922. The spleen was greatly enlarged, extending well down to the umbilicus. The count at this time was as follows: Reds 2,835,000, whites 175,000, hemoglobin 75 per cent. The differential count showed many pathological white cells, especially myelocytes.

Diagnosis: Myelogenous leukemia. Roentgen therapy was started the same day

over the anterior chest and counts were made daily until October 24, 1922, when another treatment was given. This procedure was followed until the count was as follows: December 28, 1922, reds 4,860,000, whites 66,000, hemoglobin 92 per cent. From this time on counts were made each Saturday. Treatment was given only occasionally. As long as the white count remained around 60,000, the patient felt quite comfortable and was able to carry on his daily work. During 1923 the red count went up to 5,390,000, whites 53,500, and hemoglobin 98 per cent. The patient's condition remained very good until October, 1924. At that time the glands of the groin became enlarged, the spleen became tender and occupied practically the entire abdomen. The red count had dropped to 3,015,000, whites were 22,350, and hemoglobin 72 per cent. The differential count was as follows: S. L. 2, L. L. 4, mons. 47, polys. 40, basophiles 5, myelocytes 2. The patient became gradually weaker and in November, 1924, died. We feel in this case that what remained of life was certainly made more comfortable. For two years the patient was able to work and lost comparatively little time due to treatment. In all the two years only thirteen treatments were given.

SUMMARY

1. The differential diagnosis of leukemia is often difficult and can be made only through careful study of the clinical and blood findings.

2. I do not believe any case of leukemia is ever cured, no matter what form of therapy is instituted.

3. Careful roentgen therapy is at present the most satisfactory method of treatment. That life is prolonged is problematical; the number of working days is increased beyond a doubt, and the amount of suffering is greatly decreased.

4. Frequent blood counts are imperative in the treatment of leukemia by means of the roentgen rays.

5. Do not consider each case with enlarged lymph glands accompanied by lymphocytosis, leukemia.

DISCUSSION

DR. W. G. HERRMAN (Asbury Park, N. J.): I would like to ask the essayist two questions: First, under an ameliorative X-ray treatment which type is apt to give the best prognosis, the lymphogenous or the myelogenous? And, furthermore, in what age period would he say we have the right to expect the best prolongation of life? I have two very interesting cases at the present time running concurrently. One is a male, a dentist by profession, whom I have been treating for a little more than a year; he has the lymphogenous type. His original blood count was something over two hundred thousand, and it is now running about fifty thousand. He is working every day at his profession and apparently feels in great shape and does not understand why he has to come back so often to have these X-ray treatments. I have been using a smaller dosage than the essayist and treating it rather "hit or miss," that is, treating the various glands as they show themselves, in addition to treating the spleen. The spleen at the present time is a little larger than normal, although, when we started, it extended away down below the left ilium. This man is about thirty. The other case, of the myelogenous type, is a female about twenty years of age. She came with a white blood count of over four hundred thousand; it is now somewhere around twenty thousand. The red count was a little over two million and is now three million five hundred thousand. I treated her largely over the spleen in small doses, using about a 9 inch gap, 5 ma., 12 inch distance, a dose running over six to eight minutes at a time.

Her spleen is still large. I have perhaps been doing wrong in saving the long bones until later, but because, when she came, the spleen was troubling her, I have concentrated on that. She has put on considerable weight and now feels fine. About a year ago I began to worry a little about my lymphogenous patient, and it is a little hard to keep him between fifty and sixty thousand, so if the essayist can help me on these two cases, I will appreciate it very much.

DR. F. V. MARTIN (Michigan City, Ind.): I would like to ask the essayist if he makes any difference in his treatment of the myelogenous and lymphatic types. The reason I ask this question is because my understanding is that there are pathologic changes in the bone marrow which are supposed to give the great increase in number of myelocytes.

At the present time I have a patient under treatment who came in with a temperature of 101° , spleen filling the whole right half of the abdomen. There was a white blood count of 300,000. I gave her a much smaller dose than that stated by the essayist, using a 9 inch spark gap, 5 ma., 16 inch skin distance; 3 mm. of aluminum filter, 10 minutes time over each area, treating the spleen and the heads of all the long bones. Her white cell count dropped from 300,000 to 12,000. The spleen became barely palpable. That was three months ago. Just recently she came in and the white cell count had gone back to 50,000. She was still able to do her work and is getting along very nicely, but has undoubtedly started on a relapse.

DR. T. D. CANTRELL (Bloomington, Ill.): I would like to ask a question in regard to treating the chest. Also, is the essayist still using the two hundred thou-

sand volts over the chest, and is the chest treated in one, two or three areas?

DR. LESTER LEVYN (Buffalo, N. Y.): I would like to ask Dr. Jenkinson if in any of these cases he has treated primarily the chest to determine if radiation of the heart and large vessels would produce any changes in the blood picture. I have in mind a case in which we treated the chest, spleen and long bones. This patient has remained perfectly well symptomatically for over two years. She has since married and given birth to a baby.

DR. JENKINSON (closing): I do not believe I can answer all the questions; I will, however, try to answer those I am familiar with. The most important point in the treatment of leukemia by means of the roentgen rays is the taking of frequent blood counts. Following the first treatment we discontinue therapy as long as the count is decreasing; at the first rise in the count we again treat the patient. This procedure is carried on until the count decreases to around 40,000; as long as the white count remains in this vicinity we give no further treatment.

Most all our cases have been treated over the chest. No treatment is given over the spleen or long bones. If the spleen is treated repeatedly it becomes hard and then later will show no response. The long bones are not treated, as we fear the destruction of the red cells.

The myelogenous types seem to respond more readily than the lymphatic. The acute cases have shown no progress and I am inclined to believe are harmed by therapy. Patients beyond 35 years of age seem to do better than younger patients.

I am unable to say anything about the use of radium chloride as I have not used it.

ROENTGENOLOGICAL EXPLORATION OF SPINAL AND CEREBRAL SPACES, GENITO-URINARY ORGANS AND OTHER ORGANIC CAVITIES WITH IODIZED OIL¹

By PROFESSOR J. A. SICARD, PARIS, and JACQUES E. FORESTIER, M.D.,
AIX-LES-BAINS, FRANCE

SINCE 1921, when we showed the possibilities of an iodized oil, called lipiodol (Lafay), as an opaque medium for roentgenologic exploration, we have extended the use of the preparation to a great many cavities of the body. At the same time, French and foreign investigators, taking advantage of our initial work, succeeded in enlarging the field of our general method.

Besides the two principal roentgenological uses of lipiodol—exploration of the central nervous system (spinal subarachnoid space and cerebral ventricles) and exploration of bronchial tubes—there have occurred a great many uses of minor importance, but still quite promising. We shall review here the exploration of the different cavities, except those of the bronchial tree concerning which we have written already in *RADIOL-OGY*.²

The Substance.—First, we must say a few words about the substance itself. Lipiodol is a definite chemical compound in which 40 per cent iodine is bound to a fat body—poppy-seed oil. It is not a solution: this is most important, and explains why, in spite of its high percentage of iodine, lipiodol is tolerated by human tissues and cavities as any ordinary oil. The injection of lipiodol, up to very high doses, hardly gives any reaction and generally no iodism, because there is no free iodine.

Lipiodol is a clear, transparent, yellow oil, of high density and much thicker than olive oil. All samples of brownish color or dim appearance, containing free iodine,

must be strictly avoided. The best lipiodol is delivered in small aluminum flasks, and, being antiseptic, does not require any sterilization. Lipiodol is much heavier than water and all body fluids. When injected into a duct or cavity it progresses generally to the lowest part, according to the action of gravity, in very small ducts or tubes the action of capillarity stops this progress.

Epidural Space.—The exploration of this region, between the spinal theca and the spine itself, is of great interest in all bony diseases of the spine, for early modifications here are frequently apparent. Lipiodol may be injected through the lower method "Sicard's sacrococcygeal," or through the lumbar or cervical regions.

In the latter case, the technic is the same as for a lumbar puncture, but it is important that the point of the needle, after penetrating the ligamentum flava, should not perforate the theca.³ Four to six c.c. of lipiodol may be injected, which, by its specific gravity, will slide slowly down the space toward the coccyx, leaving a deposit resembling, in the film, irregular and elongated splotches of ink. If, after the injection, the patient is put in Trendelenburg's position, it is clear that the lipiodol will slide down toward the thoracic vertebrae, the length of the track being determined by the quantity injected (Fig. 1). About six to ten hours after the injection, the progression of the liquid stops, the substance being fixed to the fatty globules contained in the space, and, until entire absorption takes place, there will be no further change in the picture presented. In case of pathologic obstruction, the lipiodol will not

¹Read before the Radiological Society of North America, at Cleveland, December, 1925.

²Roentgenological Exploration of the Bronchial Tubes with Iodized Oil (Lipiodol), Jacques Forestier, *Radiology*, April, 1926, p. 303.

³A special double needle is made by Luer (Paris) on our designs; it prevents the perforation of the dura.

flow and a roentgenogram will show the limit of its course.

Very characteristic pictures are obtained, for instance, in Pott's disease at an early stage, cancer of the vertebrae, fractures of

One c.c. of lipiodol injected into the dura, through lumbar or cistern puncture, flows down into the cerebrospinal fluid, and may be found, two minutes later, at the level of the lumbosacral angle, if the patient has

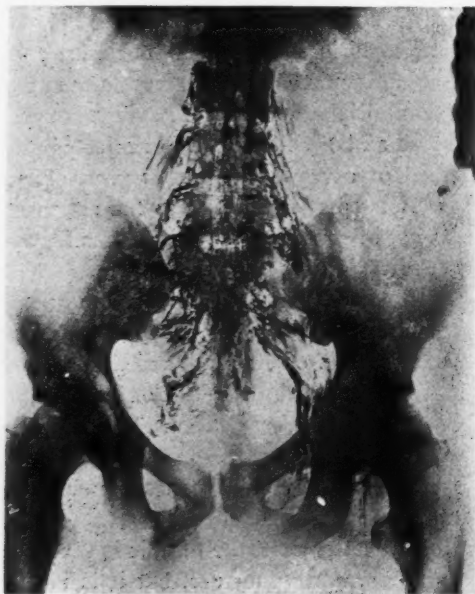


Fig. 1. *Epidural injection, normal.* Eight cubic centimeters injected through sacrococcygeal route. Patient in knee-chest position for one hour. Lipiodol has progressed along the fat layer of the space and partly escaped through the intervertebral foramina.

the spine, or in congenital abnormalities, as spina bifida occulta (André Léri), all cases in which the epidural space is blocked up. On the contrary, the way is free in case of spondylosis, chronic lumbago and spinal rheumatism. In intradural tumors, it remains free for a long time, even when there is compression of the spinal cord.

Subarachnoid Space.—There, our method has given its most important practical results, I think. It has rendered possible an early diagnosis and an accurate localization of the spinal cord compressions, improving the prognosis of those serious affections. Of 37 cases within our personal experience, all operated upon by Dr. Robineau, of Paris, there has not been a single inaccurate localization.



Fig. 2. *Intracisternal injection, normal.* Injection of 1.5 c.c. into cisterna magna through Ayer's puncture. Same patient in three positions: (A) Prone position; (B) Prone on right side; (C) Prone in ventral position; mobility of lipiodol in cerebrospinal fluid.

been placed in a standing or sitting posture (Fig. 2). The course of the globule may be examined, as well, by fluoroscopy.

There is almost no reaction: a slight headache and a rise in temperature of from 5/10 to 8/10 of a degree, and, within twenty-four hours, conditions are absolutely normal. On the other hand, if the patient has been placed in Trendelenburg's or in the knee-chest position, the globule of lipiodol, following the law of gravity, makes its way unimpeded to the cervical region or the skull. Any intradural or extradural obstruction will arrest the progress of the lipiodol, thus localizing it accurately.

The pictures of intradural growths (neurofibroma), extra-medullary or intra-medullary, are highly demonstrative, and are now known all the world over (Figs. 3 and 4).

In cases of chronic meningitis, tumors, tubercles, etc., the stoppage may take vari-

ous forms, but we cannot as yet safely base our differential diagnosis upon these forms.

Let us now emphasize a few points relative to indication, technic and interpretation.

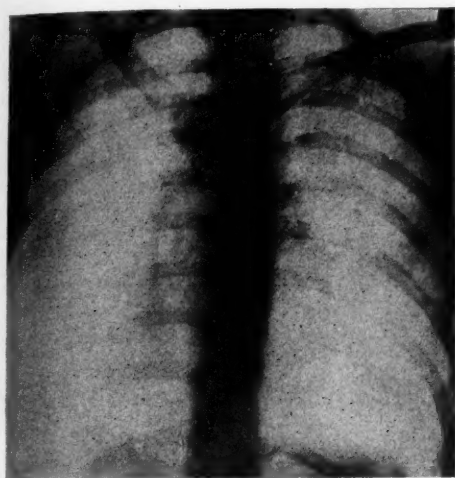


Fig. 3. *Intracisternal injection.* Intradural compression of spinal cord, clinical level first lumbar vertebra. Injection of lipiodol, 1.5 c.c. Demonstration of compression at the level of eighth vertebra. Operation proved lipiodol test to be right. (Neuroglioma of eleventh thoracic roots.)

1. The exploration is indicated only in cases of chronic radicular pain, even without paraplegia, provided the lumbar puncture shows an increase of albumen in the fluid without any cellular reaction (Sicard and Froin's albuminocytoïogic dissociation).

2. Operators are strictly warned not to perform any injection of lipiodol into the cisterna magna, within less than ten days after a lumbar puncture.

Even when there is no pathologic modification, any leakage of cerebrospinal fluid following the puncture may cause a stoppage of lipiodol, chiefly between the first and fourth thoracic vertebrae, where the channel is anatomically narrower.

3. The roentgenograms must be taken in a vertical position; those taken horizontally are of no value. Several films should be

taken within a few days from the time of the injection. In case of non-pathologic stoppage, a part or the entire dose of lipiodol flows gradually down to the cul-de-sac.

4. Lipiodol reveals the compression and

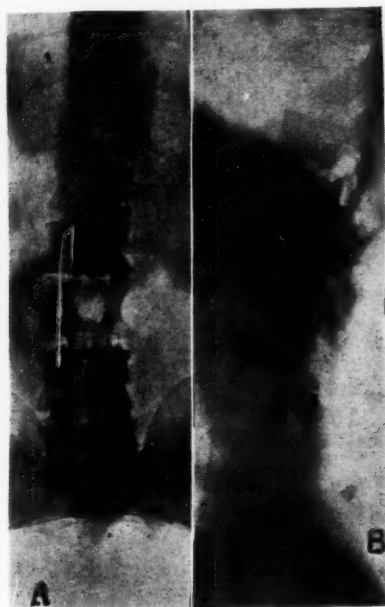


Fig. 4. *Intracisternal injection.* Extradural compression of spinal cord. Patient is war invalid. (Fracture of the spine.) (A) Frontal view; (B) Lateral view.

gives an accurate localization, but the diagnosis of the cause of compression is generally the part of the clinical investigator.

Light Lipiodol.—A few months ago, Sicard and Binet made a preparation of lipiodol with olive oil, so as to render it of lesser density than the cerebrospinal fluid. It contains only 11 per cent of iodine, but is fairly well seen on roentgenograms. It is introduced through lumbar puncture, the average dose being 5 c.c. The reaction is more important than with ordinary lipiodol, causing headache, nausea, and a rise in temperature. When there is no obstruction (in normal subjects) it ascends along the spinal cord and in two or three hours is seen in the cerebral ventricles at the top of the cav-

ities, if the roentgenogram is taken in a sitting position.

When spinal compression exists, it stops, showing plainly the lower limit of the obstacle.

is left in place and obturated, 5 to 8 c.c. of light lipiodol are pumped into the syringe and emulsified by shaking with the fluid. The emulsion is then immediately reinjected. Roentgenograms of the ventricles are ob-

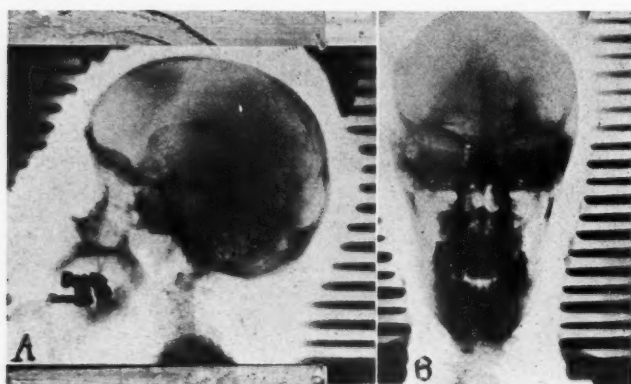


Fig. 5. Lumbar injection of emulsion of light lipiodol, normal. Through lumbar puncture 5 c.c. of lipiodol emulsified with the patient's cerebrospinal fluid. Lateral ventricles are clearly demonstrated. (A) Lateral view; (B) Frontal view.

When used in combination with ordinary lipiodol, the latter being injected above the tumor, its bulk is clearly defined. This double injection is also preconized when multiple tumors are suspected.

When there is a blockage by compression at the base of the skull, light lipiodol goes to the subarachnoid spaces of the cortex. This may help in the localization of brain tumors.

During the last few months we have tried, with Haguenau, to obtain better films of the cerebral ventricles by means of an emulsion of light lipiodol with the patient's cerebrospinal fluid, and succeeded in making good radiograms where the shapes of the lateral ventricles and even of the third ventricle were very clearly designated by a narrow but accurate opaque line (Fig. 5). The technic is as follows: Five cubic centimeters of cerebrospinal fluid are withdrawn through lumbar puncture. While the needle

tained within two or three hours. This method seems to give still better results than Dandy's air injections for the localization of brain tumors, but the reactions are stronger than with ordinary lipiodol, and our experience is too short for a definitive judgment.

Cold Abscesses.—It happens rather often that the originating point of a wandering abscess is hard to determine by clinical and even radiological examination. Four years ago we began to inject lipiodol into these abscesses with the hope of accurately determining the bony lesion from which the abscess originated. It was proved that lipiodol could be injected easily in strong doses into non-fistulized abscesses, and the result was favorable from a diagnostic as well as from a therapeutic standpoint.

The technic is most simple. The injection is performed with a rather large needle inserted into the side of the abscess, and

the dose of lipiodol injected depends upon the wideness of the sac; we generally inject between 10 and 40 c.c. It is not expected to outline, by means of the opaque fluid, the full cavity of the abscess, as barium does

terminate the exact point of origin, and in 80 per cent of the cases the exploration has been successful.

The initial attempt was made in the case of a young English girl who came to Aix-

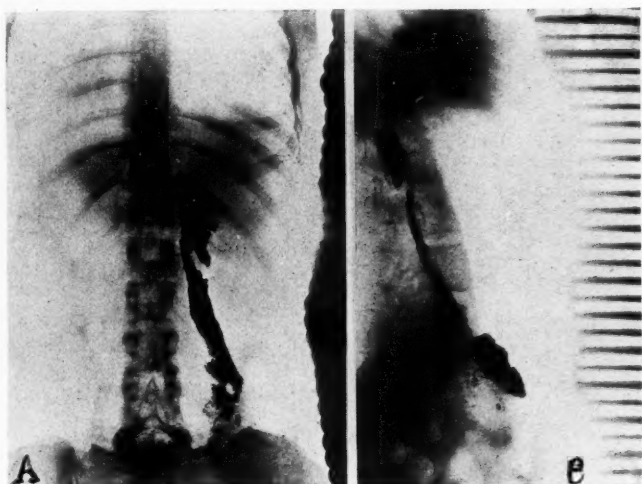


Fig. 6. Injection into cold abscess of Scarpa's angle. Latent Pott's disease. Thirty cubic centimeters injected, with patient in Trendelenburg position. Origin of abscess in eleventh thoracic vertebra demonstrated.

in the stomach, but only to give an idea of its dimensions, to visualize the path from the bony point where it originates. For that reason, it is not advisable to withdraw a great quantity of pus from the abscess; in such a condition the abscess and its sinus will be widely expanded, allowing an easy progress for the oil. After injection the patient should recline in such a position that the supposed seat of infection will be maintained below the point of the abscess where the needle has been introduced. This allows the lipiodol to reach the originating spot by gravity. The roentgenogram is to be taken from twenty-four to forty-eight hours later, the patient being kept in the right position until the film has been developed.

We have used this technic for a great many abscesses in different parts of the body, where examinations had failed to de-

les-Bains sulphur springs for a so-called "hip-joint arthritis." After clinical examination it was proved that there was no arthritis; but a few days after her arrival, she developed an abscess in the inner part of the thigh. A roentgenological examination of the hip, pelvis and spine was unsuccessful in locating the originating lesion. An injection of 8 c.c. of lipiodol was made into the cavity of the abscess and the patient was kept in the head-down position for three hours and afterwards remained in bed for twenty-four hours, till she was radiographed. The drops of lipiodol, falling into the cavity, showed a large abscess going through the pelvis up to the third lumbar vertebra, along the psoas muscle, at the same time revealing that the abscess extended to the opposite side, having the shape of a horseshoe. These indications proved

Pott's disease, which had not yet been diagnosed, and for which the patient was then treated. She now is completely cured (Fig. 6).

In the same way, exploration with lipiodol has determined the involved bone in

many of the French orthopedic surgeons—Sorrel, Roederer and Lance, for instance.

Generally speaking, what becomes of the lipiodol injected?

It is very slowly absorbed and eliminated, as may be determined from radiograms



Figs. 7 and 8. *Injection into vas deferens, normal.* After incisure in inguinal canal, 2 c.c. injected. Vas and vesicles visible. Frontal and lateral views.

cases of abscesses adjoining certain points, and mistakes have been avoided. It is impossible to quote every result obtained, but the method is now in current use among

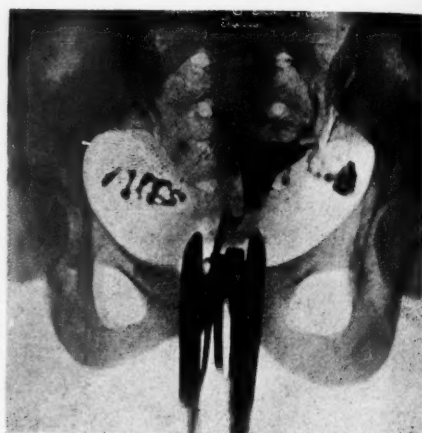


Fig. 9. *Injection into uterine cavity, normal.* Injection of 12 c.c. Both uterine cavity and fallopian tubes are visible. Drops of lipiodol have fallen into peritoneal cavity; no reaction. Patent tubes. (Masmonteil.)

taken from time to time. No untoward result has been observed from the presence of lipiodol in a cavity. We have not yet determined exactly what its part was in the success of the cases cured. In any case, it has been demonstrated that the presence of lipiodol interferes in no way with the healing of osseous tuberculosis. Among our radiograms we can show a case of Pott's disease, at present cured, in which there is some lipiodol remaining beside the spine after three years.

Male Urethra.—Lipiodol does not seem to be fit for the roentgenologic visualization of the pelvis of the kidneys, the ureters, and the bladder. The quantity of oil would be too great, the injection of any thick fluid by means of a long and narrow catheter is not easy, and the oil does not mix with water; for these reasons the shape of the

cavities named cannot be clearly demonstrated. Besides, the use of collargol and sodium iodide or bromide solutions is quite satisfactory for these organs. However, the viscosity of lipiodol and its freedom from causticity render it useful for the ex-

In normal conditions the fore part of the urethra appears as a regular canal, fully expanded on account of the resistance of the urethral sphincter. The back part, on the contrary, the extremity of which is widely open into the bladder, is seen as a narrow

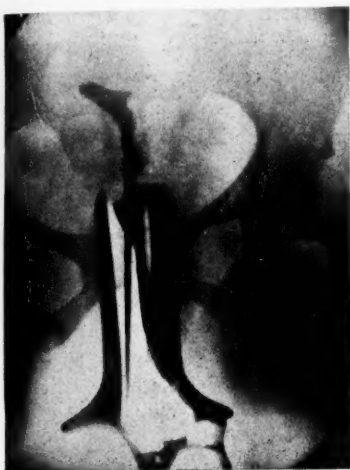


Fig. 10. *Intra-uterine injection.* Fibromyoma of uterus; obstruction of tubes; narrowing and lengthening of cavity (proved by operation). (Masmonteil.)

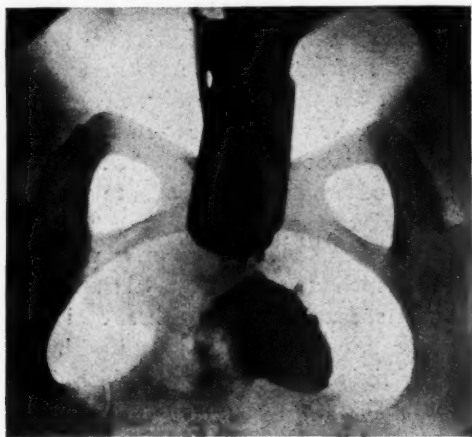


Fig. 11. *Intra-uterine injection.* Abortion; infection; hemorrhage. First biopsy was negative; lipiodol injection; demonstration of placental retention; curettage; recovery. (Masmonteil.)

ploration of the male urethra. The technic of injection is most simple. After the patient has emptied his bladder, the injection is made with a 20 c.c. syringe, the tip of which is conic. We generally use lipiodol mixed with an equal quantity of olive oil, the opacity of the mixture being sufficient for this kind of exploration. The injection is to be performed with the patient on the roentgenological couch. It is very important to take the film while the injection is going on; this is the only way of getting a roentgenogram of the whole of the canal. We take the film in normal cases while we inject 12 to 16 c.c. Frontal views show the prostatic segment of the urethra pretty well, but to get a good film of the penial and perineal segment it is better to take a lateral view of the pelvis. If several films are to be taken, another injection must be performed each time under the same conditions.

canal, which proves the normal elasticity of the walls.

In pathological conditions, all the deformities and changes in the canal are easily demonstrated—strictures, diverticula, and cysts. Though we are no specialists, we have shown the irregular shape of the canal in a case of gonorrheal strictures so that they could be localized.

In the affections of the prostatic gland the early changes revealed in the urethra by this method may be of some value in the diagnosis.

This method has been used in France by Legrand, of Rouen, and in England, where two authors, G. L. S. Kohnstam and E. H. P. Cave, have recently published a most interesting book upon the subject.

Seminal Vesicles and Vas Deferens.—At the first of the year we began, with the help of M. Grille, the roentgenologic visualiza-

tion of the seminal vesicles with lipiodol. At our first attempt we had a complete success and we can show beautiful films of these organs. A little later Lanari and Astraldi, of Buenos Aires, published some radiograms of one vesicle.

The technic is as follows: A small incision is made in the inguinal canal, under local anesthesia; the vas deferens is gently exposed, and a thin needle or trocar (six-tenths of a millimeter in diameter) is inserted into the vas in the same manner as a needle for venous puncture. We inject a mixture of two parts of lipiodol to one part of amylal, or paraffin oil, or any fluid and non-toxic liquid which can mix with oil. The injection must be performed slowly and should not cause any pain. Three cubic centimeters is quite sufficient; even with this dose there is always an excess which drops into the bladder, overflowing the vesicle. After the small wound made in the skin has been sutured, films are taken in frontal and lateral positions.

With this technic the whole length of the vas deferens is visualized and the irregular shape of the vesicle clearly shown. The excess of the opaque mixture is seen at the bottom of the bladder, but is movable with relation to the different positions in which the patient is radiographed. After the patient has urinated, that part of the opaque fluid which has dropped into the bladder is eliminated and the vesicle is entirely visible. In some cases we have injected both vesicles at the same sitting. Further examination during the following days has shown that after ten days nine-tenths of the opaque mixture have been eliminated. We have explored normal subjects only (Figs. 7 and 8). Whether this injection may have some therapeutic value in infectious diseases of these organs, is a question which we hope the urologists will soon be able to answer.

Uterus and Fallopian Tubes.—The possibility of getting good roentgenograms of these cavities with lipiodol has been dem-

onstrated by Portret and Cotte in France, Heuser, Carelli, Gandulfo and Ocampo in Argentina. After two years of experiment, the innocuous quality of the injection may be asserted, and the results obtained in the examination of the cavities may be stated to be of value.

The technic is very simple, but requires a special instrumentation. This consists of a long metallic catheter, about the size of a hysterometer, to which a 20 c.c. syringe can be joined for the injection. About two centimeters from the extremity is screwed directly a metallic olive which can be moved alongside the catheter, within a limit of three centimeters. This olive makes an exact obturation of the cervical canal, during the injection and the exposure, and prevents the lipiodol escaping from the cavity. The catheter can be joined to a special uterine forceps by means of a bolt. Ordinary gum catheters of different diameters may also be used.

The injection is performed under the radiological screen, the patient being in the gynecologic position. After the vaginal speculum has been set in place the cervix is caught with a forceps and the catheter inserted into the cervical canal. When it is in the right position, the catheter is fixed to the forceps, to prevent the reflux of lipiodol into the vagina, and the injection is pushed slowly, till the patient feels a little pain; generally at the same moment, from the over-pressure, some drops of oil escape from the cervix. The average dose in non-pregnant women is 4 to 12 c.c. It is advisable to watch under the screen the filling of the uterus and the progress of lipiodol through the tubes.

A film is taken immediately. If the tubes are obvious, the quantity is sufficient; if they are not, a little more lipiodol may be injected. If the tubes remain unchanged after the second trial, this means a pathological obturation. If an excess of lipiodol has been injected, and has gone through the

tubes into the peritoneum, this does not cause any painful reaction or accidents. In a case of salpingo-ovaritis a few cubic centimeters of lipiodol have been found in the peritoneum two days after an exploration. There was no peritoneal reaction (Masmon-teil).

What are the results of the examination?

1. It is a help toward diagnosis of the patency of the fallopian tubes and it may be used as an addition to or to replace the Rubin test with air. It localizes the obstruction, which the Rubin test cannot do. The patency of the tubes can be asserted only when lipiodol has been seen under the screen going through the tubes and falling into the peritoneum. The image of an injected tube on a radiogram has no significance; it may exist with an obstruction at the extremity (Fig. 9).

2. In case of uterine infection or hemorrhage, the lipiodol test is simpler and more harmless than a curettage, and can show the presence of a placental retention, fibroid, or carcinoma (Fig. 10). In some cases it is a guide for the curettage, and shows the pathological parts of the uterine cavity (Fig. 11). Grégoire and Bécclère have been able to diagnose cysts of the large ligament by means of this "uterography."

3. Heuser has used it for the diagnosis of pregnancy in the first month, the ovule being rendered visible by the test. We do not know personally whether this practice is harmless or not. In any case, we feel sure that the lipiodol test will be of practical value for gynecologists in the future.

Facial Sinuses.—Among these cavities, the maxillary sinuses have been examined with lipiodol by Worms and Reverchon.

The injection is made through a fistula, or after trephining the sinus: lipiodol to the amount of 5 to 10 c.c. is injected without any danger, and several films are taken in

different positions as soon as possible after the injection.

The shape of a normal sinus is easily recognizable; in case of pathological changes, the irregularities of the forms, the diverticula or cysts may be accurately demonstrated (Fig. 12). We cannot yet judge as to the possibilities for diagnosis from such an exploration, but it is surely quite harmless.

Lachrymal Ducts.—Bollack, of Paris, in 1923, performed the first examination of the lachrymal ducts with lipiodol.

The technic is most simple and does not need any other instruments than those of the specialty. The injection is performed with a one c.c. syringe and does not require more lipiodol. After dilatation of a lachrymal point, a thin trocar or needle is inserted and the lipiodol slowly injected. The film must be taken in the frontal position, as soon as possible, because the duct, being open at its lowest extremity, the lipiodol drops into the nasal cavity within five to seven minutes; the duration of the transit is of some interest in the exploration.

In normal subjects the canaliculi, sac, and lachrymo-nasal duct are delicately visible, the sac being itself hardly wider than the canal. In dacryocystitis, the enlargement of the sac and the obturation of the duct are demonstrable; the irregularity of the walls of the sac are characteristic of peridacryocystitis.

Fistulae.—The use of Beck's paste for the roentgenological examination of fistulous tracts has been a great improvement in surgery. Lipiodol may be preferred to Beck's paste in several conditions:

1. In very small fistulae where there is no possibility of injecting thick paste.
2. When the fistula is suspected of leading to an organ of great sensitiveness (lung, liver, dura, etc.).

The injection must be performed, if possible, on the radiological table, and the ori-

fice obturated by collodion to prevent the reflux.

We have injected fistulæ of all kinds, in connection with bony or visceral foci, without accident and with excellent roentgenologic results.



Fig. 12. Injection into maxillary sinus. Chronic sinusitis. (Worms and Reverchon.)

Lately, in France, Cotte, Lefèvre and Monties have used lipiodol for the exploration of biliary fistulæ instead of barium or collargol, which would irritate the liver ducts, and give toxic effects.

To test the patency of the choledochus after cholecystectomy, lipiodol is injected through the drain before it is removed. In several cases Cotte was able to visualize a gallstone in the choledochus which had escaped the surgeon at the time of the operation and was blocking the canal. In other cases, intrahepatic cavities or cysts in connection with fistulæ were demonstrated and localized.

Salivary Glands.—José Uslenghi has this year published the technic of the radiological exploration of these glands with lipi-

odol, and has shown very fine films of the submaxillary gland. We cannot say what the value of this examination will be.

Intra-arterial Injections.—These have proved to be useful in case of gangrene of the extremities, to localize the clot or the

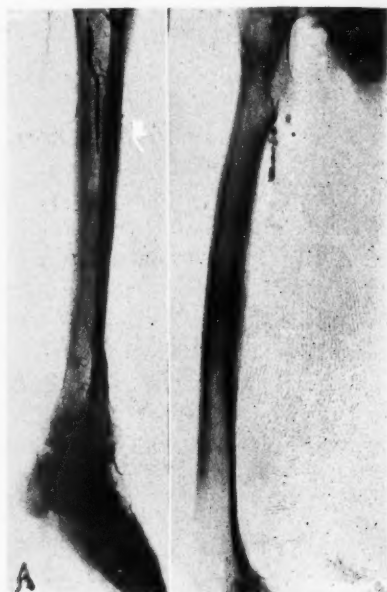


Fig. 13. Intra-arterial injection. Arterial obstruction; gangrene of the limb. Injection above the obstruction: (A) Thrombosis in tibial artery—collateral paths are visible; (B) Embolus in femoral artery; operation; recovery.

thrombus. Lipiodol may be injected directly into the main artery of the limb, under local anesthesia, and does not provoke acute pains as saline solutions (sodium bromide), the injection of which requires general anesthesia (Coste and De Gennes). The injection is performed just before the operation, 3 to 5 c.c. of lipiodol being injected with a thin needle. The film shows the upper limit of the vascular obstruction, and the collateral branches. These are useful guides to the surgeon (Fig. 13). There is no danger that the lipiodol will block the collateral branches, because it goes easily through the peripheral capillary network.

Activity of Gastric Secretion.—On account of its quick absorption by the diges-

tive mucous membrane, lipiodol is not to be used as an opaque medium for the exploration of the digestive tract, in the same way as bismuth and barium are used. Ten cubic centimeters of lipiodol, taken through the mouth, will cause a rather strong iodism. But the opacity of lipiodol and its relative fluidity have enabled Forestier, with Loeper, and Leforestier, to use it as a test for the secretive activity of the stomach.

We use gelatin capsules containing 20 centigrams of lipiodol. Two of these capsules are swallowed by the patient on an empty stomach, and the digestion of the gelatin wall is observed under the fluoroscope. The round shape of the capsules enables them to be easily visible on the screen during their stay in the stomach. When the capsule has been digested by the gastric juice, the lipiodol escapes and is seen, as a small curved line, in the fundus. With our capsules, normal subjects digest gelatin in from fifteen to seventeen minutes. In cases of gastric ulcer and hyperpepsia the time drops to from five to seven minutes; in cancer or hypopepsia it rises up to forty minutes and more. This is an exact measurement of the gastric activity *in vivo*, which may prove of real benefit to the specialist.

Bones and Joints.—Injections performed into the bone marrow and joints for therapeutic purposes have given us very peculiar roentgenograms. The progress of the lipiodol along the bone marrow of the tibia is quite different in osteitis deformans from that in osteitis fibrosa.

The shape of the capsule of the knee joint can be easily visualized after several intra-articular injections of lipiodol, with rather painful reactions.

Experimental Uses.—The innocuous nature of lipiodol makes it quite fit for experimental uses on living animals. We have examined the different capillary networks on living dogs, and have been able to visualize the blood stream on the screen.

It is really an attractive experiment to perform an injection of lipiodol into the femoral vein of the dog. The globules of opaque oil are caught by the blood stream, and seen, gliding toward the heart, going

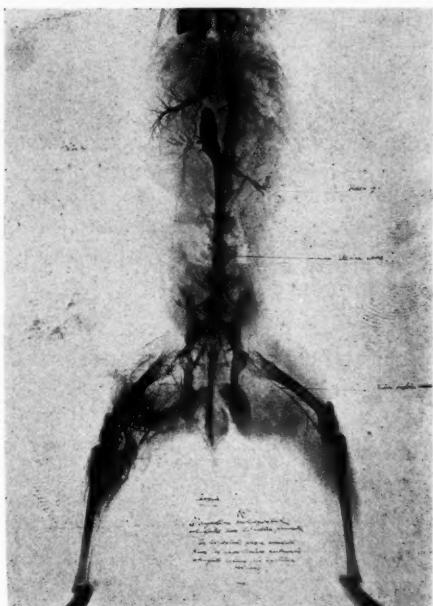


Fig. 14. *Experimental injection on rabbit.* Intra-arterial injection continued till animal's death; lipiodol has gone through the capillaries and is seen in the venous system.

through its right cavities, and thrown quickly into the pulmonary arteries, where there is a stoppage in the pulmonary capillary network. A quarter of an hour later the droplets of oil have crossed through the obstacle. This is an experimental method of studying fat embolism. A dose of 1 c.c. per pound of animal weight has been followed by no fatal result.

We have, in the same manner, with intra-femoral injections explored the peripheral networks, through which lipiodol goes very easily. After an injection into the renal artery, there is a stoppage of a few minutes in the kidney and a stoppage in the liver of from two to three hours after an injection

in the vena porta. The intra-carotidian injection has been fatal to the animal (Fig. 14).

CONCLUSIONS

Lipiodol is a means of contrast for radiodiagnosis, which provides full safety.

Beside the principal roentgenologic uses of lipiodol (bronchial tubes, and cavities the spine), there exist several uses of minor importance, but of some interest. Uterus and fallopian tubes, cold abscesses, the male urethra, vas deferens and seminal vesicles, facial sinuses, lachrymal ducts, biliary fistulae and limb arteries have been explored by us or other investigators as an application of our general method.

Valuable results in diagnostic respects have been obtained.

Lipiodol has proved quite useful for experimental purposes, especially for the visualization of the blood stream and the exploration of the permeability of the capillary networks in animals.

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DISCUSSION

DR. H. E. RUGGLES (San Francisco): I would like to report that we have been using this method for about a year. One of our pediatricians came home from France and told us about it, and we have had about thirty lung injections. We can testify to the ease and simplicity of the application of the oil. We early gave up the trocar method in favor of direct introduction through the larynx. After cocaineization, it is easy, with a curved syringe, to put 30-50 c.c. of oil into the trachea, and there is surprisingly little reaction. The patients are injected on an

upper floor of our office building, come down in the elevator, and are radiographed when we can take them. On one occasion we injected a physician under fluoroscopic control, and were able to put 40 c.c. into his lungs in the course of five minutes without the least discomfort, with no cough, and with practically a complete filling of the bronchi on both sides up to the level of the bifurcation of the trachea.

In our hands, the particular value of this method has been in cases of bronchiectasis, particularly with cavities behind the heart, where plain films, even in the lateral view, are apt to be negative. The oil produces such striking shadows and works so well, that I think its use should be a routine procedure in all examinations for bronchiectasis.

DR. JACQUES FORESTIER (closing): I must express my thanks to Dr. Ruggles and to Dr. Pariseau for their kind words about my method. I think that they have had indeed very good results, and I cannot tell, myself, which manner of injection is def-

initely the better. I think that this matter calls for some further experimental work, and, afterwards, we shall be able to fix on a proper technic.

Some one has asked me for how long a time the residue of lipiodol is visible in the lungs. Of course, one cannot name an exact time, because each case differs from the others, but I will say that in normal subjects the elimination is quicker than in pathological ones. In none of my cases has the patient kept lipiodol shadows for more than three or four months. Some have spoken of lipiodol retained in the bronchial tree for one or two years, but I have never had such an experience. This is possible in other cavities of the body, as I shall explain later, but I do not think it constitutes a real drawback to the method, if one is aware of it. I feel grateful to the experimenters who have tried to do the same kind of work that we have done, and I hope that they will succeed in getting better results in chest diagnosis, and that will be for the greater benefit of our patients.

AN X-RAY STUDY OF THE DEVELOPMENT OF THE OSSIFICATION CENTERS OF THE SKELETAL SYSTEM¹

By BUNDY ALLEN, M.D., IOWA CITY, IOWA

WHILE nothing new as a definite fact is offered in this contribution it is presented with the idea of stimulating interest in what we believe will prove to be of value in diagnosis. The discussion of the skeletal ossification centers the writer wishes to present as a preliminary study.

In all probability the consistency of the osseous development may now or in the future be shown by the X-ray to bear a direct relation to existing or future pathological lesions. If the secondary lesion, as it were, is not present at the time of examination, we may find direct evidence of a bony change which will materialize in a definite pathological lesion in later life.

The development of the ossification centers of the skeletal system has been studied and reported more or less in detail many times. The time allotted is not sufficient for an extensive discussion of the entire system; therefore, the study will be limited principally to the bones of the wrist (carpus).

A nucleus appears in the os capitatum and the os hamatum in the first year; in the os triquetrum in the second to fifth year; in the os lunatum in the third to sixth year; in the os naviculare, os multangulum majus and os multangulum minus in the third to sixth year, and in the os pisiforme in the tenth to fourteenth year. In each bone there may occur two nuclei or centers of ossification.

1. Os magnum
Female between the third and sixth month.
Male between the fourth and tenth month.
2. Unciform
Female between the fifth and tenth month.
Male between the sixth and twelfth month.
3. Cuneiform
Female between the second and third year.
Male when about three years of age.

4. Semilunar
Female between the third and fourth year.
Male when about four years of age.
5. Scaphoid
Female at four years of age, or early in fifth year.
Male when about five years of age.
6. Trapezoid
Female between fourth and fifth year (preceded by trapezoid).
Male between fifth and sixth year (preceding trapezium).
7. Trapezium
Female between fourth and fifth year (preceded by trapezoid).
Male between fifth and sixth year (preceded by trapezoid).
8. Pisiform
Female between the ninth and tenth year.
Male between the twelfth and thirteenth year.

The present-day X-ray study of the osseous centers is not conclusive evidence alone. There are numerous factors materially affecting the findings. The technic for exposing the film is in all probability the most prominent source of error. The density of the bone exposed is at this time the essential factor and the physical problem which must be solved before dependable data can be obtained. The consistency of the normal as well as abnormal developing bone without question varies from nascent to complete ossification. Due to the wide variation of bone density one is dealing with an individual case in each bone exposed. If the roentgen technic could be standardized, so that the factors might be duplicated from time to time, the great problem of variation in density would still be unsolved. The variation in density of developing bone is the essential factor which renders the data obtained in measurement of the areas of carpal as well as other bones of the human body unreliable.

In the Department of Child Welfare in the State University of Iowa many hundred carpal bones have been accurately measured,

¹Read before the Radiological Society of North America, at Cleveland, December, 1925.

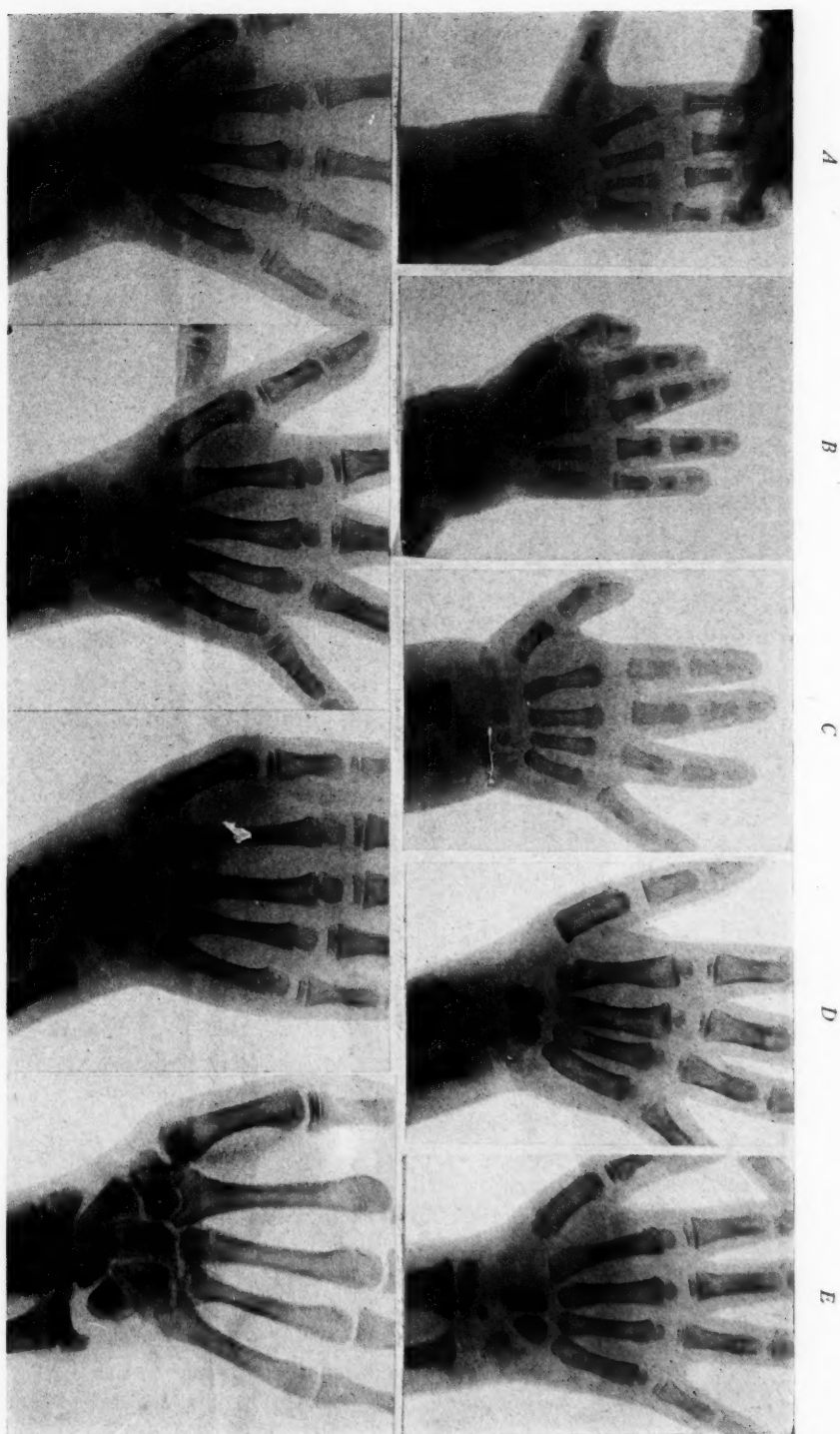
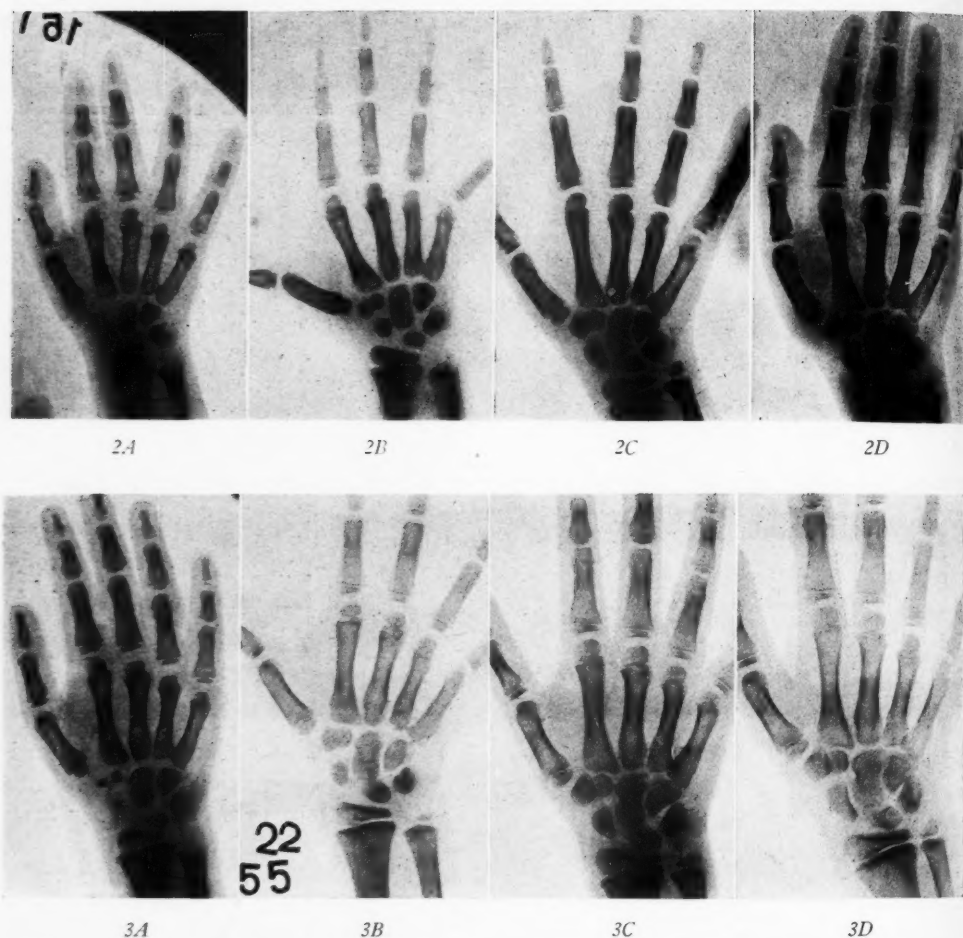


Fig. 1. Development of the carpal bones from the ages of 2 months 7 days to 13 years 1 month 26 days. (A) 2 months 7 days. (B) 3 months 2 days. (C) 4 months. (D) 3 years 4 months 23 days. (E) 3 years 4 months 25 days. (F) 4 years 9 months 9 days. (G) 5 years 4 months 19 days. (H) 8 years 6 months 28 days. (I) 13 years 1 month 26 days.



Figs. 2 (above) and 3 (below). Hands of twins (A. B. and J. B.) from the age of 4 years 2 months to 9 years 6 months. (2A and 3A) 4 years 2 months. (2B and 3B) 6 years 7 months. (2C and 3C) 8 years 5 months. (2D and 3D) 9 years 6 months.

using, as far as possible, a standard technic, consisting of a standard anode plate distance as well as all other roentgen factors. All measurements as shown by the charts were very carefully made by Mrs. Busby, with a planimeter, but no standard bone density was available.

Dr. J. W. Pryor² states that "*the bones of the female ossify in advance of the male.*"

In the study of the bones of the wrist in

the University of Iowa the charts show that ossification progresses much more rapidly in females than in males up to approximately the eleventh year. From the age of eleven to fourteen approximately the development of males and females is equal. From the age of fourteen approximately the ossification progresses much more rapidly in males than in females. Among other varying points of interest is the fact that ossification varies markedly in the right and left wrist of the same individual. Individuals who

²J. W. Pryor, Bull. Univ. Ky., VIII, No. 11, p. 3.

are right-handed may have an advanced ossification of the left carpals and *vice versa*.

No definite time has been observed for the beginning or the completion of ossification or the union of the epiphyses. This point is true in males and females who are clinically perfectly normal, and variations may be observed in normal individuals to the same degree as may be found in clinically abnormal subjects.

As stated in the *Paris Thesis*, many criticisms of roentgenographic examination of the centers of ossification have been made. It has been stated that the X-ray does not show all the centers that are present. Histological examination of the centers of ossification shows that the centers pass through four stages.

1. An increase in the growth of the cartilage cells.
2. A stage of calcification.
3. A stage of vascularization.
4. A stage of complete ossification.

Theoretically the centers should become visible on the plate at the time of calcification. A very accurate exposure technic must be employed to have positive findings where the calcium element is limited.

MEDICO-LEGAL ASPECTS

The study of the ossification of the skeleton is one of the best methods of determining the age of a fetus born before term, of determining whether an infant is born at or before term, the age of an individual below the age of thirty, etc. This study is made by direct examination on dissection, and, while very time-consuming, is very accurate. If roentgenography cannot be substituted for direct examination, it can at least serve to determine whether or not an infant is born at term.

An illustrative case is as follows:

A woman had an abortion. The physician found a fetus 13 cm. long which appeared to be at about the end of the third



Fig. 4. Wrist joints of two patients having proven otosclerosis whose bones show evidence of a rachitic change.

month of intra-uterine life. A roentgenogram showed that the pubis and ischium were not formed (these bones are formed at about the fourth or fifth month). It showed the lateral centers of the dorsal and lumbar vertebræ, which appear at the age of two one-half to three months, but the median vertebræ, which appear at the fourth to fifth month, were not visible. The centers of the metatarsals, metacarpals and phalanges were seen (these centers normally appear at the third month). The center of the calcaneum (which appears at the fifth or sixth month) was not visible. Hence these findings showed that the fetus was at the end of the third month of intra-uterine life.

Roentgenography may render an important service in the case of twins, especially in countries where the law gives the majority of the estate to the elder. There are rare cases on record in which twins have been expelled simultaneously. Sometimes the physician does not arrive until both infants have been born. Finally, in cases of cesarean section the rights of priority depend upon the situation of the fetus with relation to the abdominal wall. A more satisfactory and scientific method would be to establish the relative ages of twins by the condition of their ossification centers, as determined by the roentgenogram.

A very interesting and valuable discussion is given by Dr. Charles Thurstan Holland.⁸ Routine examination of the body, particularly of such parts as have been the seat of accident, often raises doubts concerning whether the appearances seen are the results of force or of development. This is particularly the case as regards the foot. The accessory bones of the foot are of very special importance from a medico-legal point of view, and the frequency of the presence of some of them, as shown by roentgenograms, is somewhat surprising. The accessory

bones of the hand, Holland believes, are very much less common and of far less importance. There are some ten or eleven of the foot bones altogether, but some of them are not of much importance owing to their extreme rarity, and some do not lend themselves to a demonstration by X-rays. They are: (1) *Os trigonum*; (2) *os sustentaculum proprium*; (3) *calcaneus accessorius*; (4) *calcaneus secundarius*; (5) *ossiculum trochleæ*; (6) *tibiale externum*; (7) *cuboides secundarium*; (8) *os intercuneiform*; (9) *sesamum peronacum*; (10) *os intermetarsum*; (11) *os Vesalianum*.

The first one is known usually as the *tibiale externum*, and is situated on the posterior and external side of the tuberosity of the scaphoid. It has been demonstrated by the roentgenogram at the early age of three years. The presence of this bone may give rise to tarsalgia and even local manifestations of inflammation, and it may be mistaken roentgenographically in cases of injury for a fracture of the tuberosity of the scaphoid. To assist in making an exact diagnosis, the other foot should always be examined, and in the large majority of cases this bone will be found to be present also in this other foot. A similar condition in both feet would obviously put fracture practically out of court.

Further in making a differential diagnosis, the appearance of the edges of the bones is valuable, as in cases of injury the edges of a fractured bone will almost certainly be irregular, while, on the other hand, the lines of both it and the adjacent scaphoid will be quite normal and well defined when the condition is that of an accessory bone.

IN INJURIES ABOUT THE ANKLE JOINT THE OS TRIGONUM IS OF IMPORTANCE

Normally the posterior part of the astragalus is drawn out backwards into a projection, and in some roentgenograms shows very prominently. Now the *os trigonum* when present is situated just at the back of

⁸C. T. Holland, *Jour. Anat.*, July 1920-21, LX, 235.

the upper surface of the astragalus, and roentgenographically shows in such a position that it may simulate a fracture of this projecting piece of the bone. There is no doubt, according to some authorities, but that it is a distinct bone, and Dwight has found it distinct in cartilage at birth. It is not known ever to give rise to any symptoms. Apart from the X-ray appearance already described as helping to distinguish a true bone from a fracture at the posterior end of the astragalus, the true bone is usually symmetrical and should be seen in the other foot. In the clinic in the University we have had a number of patients—athletes, particularly men on the football and basketball teams—report with a complaint of injuries of the ankle joint. These injuries are painful and show the os trigonum or a fracture of the astragalus at the time of entrance. From our experience we have concluded that in the majority of these cases the patient has a fracture of the astragalus.

Other bones of the foot, of equal interest, should be carefully studied in the roentgenograms.

May we at this time deviate and discuss a pathological condition that apparently is quite closely associated with bony development?⁴

The pathological discussion of the bone changes in the various stages of progressive deafness fails to compare the temporal bone changes with those of other parts of the body, but whether or not there is a general change in the bony framework of the body has not been determined, except as may be anticipated from the amount of calcium and phosphorus eliminated in the urine. This would account for the blood calcium changes observed in the advanced cases that have come to be called otosclerosis. These changes consist in faulty deposition and absorption of bone salts, with cellular infiltration in the haversian canals and along the

vascular spaces. In the Department of Nose and Throat we have had a considerable number of patients with a clinical diagnosis of otosclerosis. Otosclerosis is a disease of the ears, functionally characterized by the loss of hearing for low tones, a negative Rinné, and an increased bone-conduction, and pathologically characterized by a bony spongification of the temporal bone near the labyrinth capsule, most frequently appearing near the oval window.

The question arose as to whether or not the condition might be due to or a continuation of the abnormal constituents of bone present in the early life of the individual. The bony pathology in otosclerosis apparently is closely related to the bony pathology in rickets. Rickets is a common nutritional and metabolic disease of the first two years of life, the chief characteristic of which is the failure to appropriate or retain calcium in the bones, which become soft and deformed. If the pathology in otosclerosis can be proven to be that of rickets, then we must infer that the etiology of otosclerosis is similar to that of rickets.

Pathological conditions in the ear in otosclerosis have been variously described on the basis of microscopical examination of the temporal bone and its appearance after death.

The word "otosclerosis" is in itself descriptive of the condition noted by early investigators, who first recognized the disease as a distinct clinical entity and summarized the functional indications as follows: The lower tonal limit is elevated; the Rinné test gives a negative result, and the bone-conduction is increased.

Sixty-three cases have been studied in the University Hospital. Eighty-four per cent of the cases examined were under forty-five years of age. The disease is rarely diagnosed in children under the age of sixteen, but in this study 35 per cent reported that deafness was noted before the end of the sixteenth year. The youngest patient in

⁴Callison, J. G., *Progressive Systemic Deafness as an Endocrine Syndrome*. N. Y. Med. Jour., July 6, 1921.

this series in whom this condition existed was eleven years of age.

In this preliminary discussion we may be permitted to say that one of the important syndromes shown in the early recognition or prevention of otosclerosis might be obtained by the study of the bony development of the child. The relation between otosclerosis and the bony development is being presented at this time, not as a conclusion, but with a hope of stimulating a sufficient interest to prove or disprove the relation. If the fact could be established that otosclerosis is a progressive bone lesion, present in the form of a rachitic change, many patients might receive medical treatment in the

way of cod liver oil, diet, etc., to retard the process of the early bone lesion which is a progressive development.

Two problems we hope to solve and report on in the near future:

First: the development of a standard technic to demonstrate the density of bones as shown on the X-ray film.

Second: a large number of clinical cases will be followed to establish definite data on the relation of the osseous development to otosclerosis, which is now apparently a pre-existing condition.

The following tables show the ossification of the bones of the skeletal system.

TABLE OF OSSIFICATION OF THE BONES OF UPPER EXTREMITY
(Days and weeks refer to the pre-natal, years to the post-natal, period.)

Bone	Centers	Time of appearance of centers	Union of first and second
<i>Clavicle</i>	Diaphysis Sternal epiphysis	Sixth week Eighteenth to twentieth year	Two centers lateral and medial blend on forty-fifth day. Shaft and epiphysis unite between the twentieth and twenty-fifth years.
<i>Scapula</i>	Primary centers 1. That of the body, the spine and the base of the glenoid cavity. 2. Coracoid process 3. Subcoracoid Epiphysis Acromial epiphysis Epiphysis of the inferior angle Epiphysis of the vertebral border Epiphysis of surface of glenoid fossa Epiphysis of upper surface of coracoid	Eight week First year Tenth to twelfth year Fifteenth to eighteenth year Sixteenth to eighteenth year Eighteenth to twentieth year Sixteenth to eighteenth year Sixteenth to eighteenth year	Coracoid process joins body at age of puberty; subcoracoid and the epiphysis of coracoid and the glenoid fossa join between eighteenth and twenty-fourth years.
<i>Humerus</i>	Diaphysis Head Great tubercle Small tubercle Capitulum Epicondyle medial Lateral margin of trochlea Epicondyle lateral	Sixth to seventh week First to second year Second to third year Third to fifth year Second to third year Fifth to eighth year Eleventh to twelfth year Twelfth to fourteenth year	Epiphysis, head of great tubercle, and small tubercle unite in fourth to sixth year, and with shaft in the twentieth to twenty-fifth year. Shaft in twentieth year. Epiphysis of medial and lateral epicondyle join the shaft sixteen to eighteen year.

(Table Concluded)

Bone	Centers	Time of appearance of centers	Union of first and second
<i>Radius</i>	Diaphysis	Seventh week	Superior epiphysis and shaft unite between seventeenth and twentieth years. Inferior, twenty-first to twenty-fifth year.
	Epiphysis		
	Carpal end	Eighth month to fifteenth month	
	Humeral end	Fifth to seventh year	
<i>Ulna</i>	Diaphysis	Seventh week	Proximal epiphysis and shaft are united about seventeenth year. Inferior epiphysis, eighteenth to twenty-fourth year.
	Carpal end	Sixth to eighth year	
	Humeral end	Tenth year	
<i>Carpus</i>	Os capitatum	Third to sixth month	They have two centers of ossification, characteristic of each base at an early period.
	Os hamatum	Fifth, tenth, twelfth months	
	Os triquetrum	Second to third year	
	Os lunatum	Third to fourth year	
	Os naviculare	Fourth or early in fifth	
	Os multum major	Fourth to fifth year	
	Os multum minor	Fifth, sixth year	
<i>Metacarpals</i>	Os pisiforme	Twelfth to thirteenth year	Epiphysis unites with shaft between fourth to sixth to fourteenth year; fifteenth to twentieth year.
	Diaphysis	Ninth week	
	Proximal epiphysis of first metacarpal	Third year	
	Distal epiphyses of the metacarpals		
<i>Phalanges</i>	Diaphyses	Ninth week	Epiphysis in middle finger first appears, followed by fourth, second, fifth and first digits. Epiphyses of phalanx of middle finger first appear.
<i>First row</i>	Proximal epiphyses	First to third year	
<i>Middle row</i>	Diaphyses Proximal epiphyses	Eleventh to twelfth week Second to third year	
<i>Terminal row</i>	Diaphyses Proximal epiphyses	Sixth to eighth week Second to third year	Fusion of epiphyses of phalanges with diaphyses takes place in the eighteenth to twentieth year.
<i>Sesamoid Bone.</i>			Ossification begins generally in thirteenth or fourteenth year. May not take place until after middle life.

TABLE OF OSSIFICATION OF THE BONES OF LOWER EXTREMITY

(Days and weeks refer to the pre-natal, years to the post-natal, period.)

Bone	Centers	Time of appearance of centers	Union of first and second
<i>Os innominatum</i>	Os ilitium	Fifty-sixth day	The rami of ischium and the pubis are united by bone in seventh or eighth year. Osseous union takes place earlier on the pelvic than on the articular surface of the acetabulum. Union is now completed about the twentieth year.
	Os ischii	One-hundred-fifth day	
	Os pubis	Fourth to fifth fetal month	
	Os acetabuli	Ninth to twelfth year	
	Epiphyses: those of the acetabulum	Soon after puberty	

(Table Continued)

Bone	Centers	Time of appearance of centers	Union of first and second
	Crest of ilium	Soon after puberty	Fuses with main base, twentieth to twenty-fifth year.
	Tuberosity of ischium	Soon after puberty	Fusion begins in the seventeenth and is completed between twentieth and twenty-fourth years.
	Ischial spine	Soon after puberty	Eighteenth to twentieth year
	Anterior inferior spine of ilium	Soon after puberty	Eighteenth to twentieth year
	Symphyseal end of os pubis	Eighteenth to twentieth year	After twentieth year
<i>Femur</i>	Diaphysis	Second day	
	Epiphyses	Shortly after birth	Twentieth to twenty-fourth year
	Distal end	First year	Eighteenth to nineteenth year
	Head	Third to fourth year	Eighteenth year
	Great trochanter	Eighth to fourteenth year	Seventeenth to twenty-second year
	Lesser trochanter		
<i>Patella</i>		Third to fifth year	Osseous process reaches definite form shortly before puberty.
<i>Tibia</i>	Diaphysis	Forty-fourth day	
	Epiphyses	About birth	Nineteenth to twenty-fourth year.
	Proximal end	Second year	Sixteenth to nineteenth year
		Thirteenth year	Fuses with epiphysis of proximal end, then with this to diaphysis.
<i>Fibula</i>	Diaphysis	Fifty-fifth day	
	Epiphyses	Second year	Twentieth to twenty-second year
	Distal end	Third to fifth year	Twenty-second to twenty-fourth year
<i>Calcaneus</i>	Chief center	Sixth fetal month	Fourth or fifth fetal months.
	Epiphysis, distal end	Seventh-eighth-tenth year	Fifteenth to sixteenth year
			Sixteenth to eighteenth to twentieth year
<i>Cuboid</i>		About birth	
<i>Cuneiform (third)</i>		First year	
<i>Cuneiform (first)</i>		Second to third year	
<i>Cuneiform (second)</i>		Third to fourth year	
<i>Movicular</i>		Fourth to fifth year	
<i>Metatarsal</i>	Diaphyses	Eighth to tenth week	Ossification appears later than time of puberty.
	Epiphyses		Epiphyses unite with shafts in seventeenth to twenty-first year. In females in fourteenth to nineteenth year.

(Table Concluded)

Bone	Centers	Time of appearance of centers	Union of first and second centers
<i>Phalanges</i>	<i>Terminal row</i>		
	Diaphyses	Fifty-eighth day	Thirteenth, twenty-third, to sixteenth to twenty-first years.
	Epiphyses, distal	Fourth year	
<i>Middle row</i>	Diaphyses	Fourth to tenth fetal month	Thirteenth to nineteenth year.
	Epiphyses	Third year	
<i>Proximal row</i>	Diaphyses	Third fetal month	Fourteenth to seventeenth year.
	Epiphyses	Third year	Centers for shafts appear, often double. Ossification of epiphyses appears as early as second or even first year.
<i>Sesamoid bones of great toe</i>		Twelfth to fourteenth year	Ossification begins in the eighth year in females, in eleventh year in males.

The following chart shows the same data on examination of twins.

	X-ray number	Right area	Left area	Height	Weight	Mental age	Chronological age
A. B. (male)...	15154	203	215	101	15.9	4-1	4-2
	15154	464	497	114	19.7	7-4	6-7
	216	666	656	124	23.0	9-5	8-5
	463	759	758	128.2	24.6	10-8	9-6
Totals		2092	2126				
Average		523	531.5				
J. B. (male)...	15155	315	318	105.1	17.9	4-3	4-2
	15155	575	585	118	20.7	7-4	6-7
	202	757	763	128.2	24.4	9-4	8-5
	464	899	896	134.9	26.6	10-7	9-6
Totals		2546	2562				
Average		636.5	640.5				

The following chart shows a small part of a large number of children's wrists, giving in detail the areas of right and left carpals, height, weight, mental and chronological age of the child.

Sex	X-ray number	Right area	Left area	Height	Weight	Mental age	Chronological age
F	318	1162	1150	137.9	26.6	13 7	12 8
F	27676	1330	1216	154.9	39.9	15 8	12 8
F	347	1355	1264	157.6	43.4	16 3	13 2
F	392	1584	1592	159.5	44.1	11 2	13 2
M	335	841	841	142.6	32.7	12 11	12 8
M	18170	1340	1341	152.5	39.2	15 7	12 7
M	337	1368	1368	154.1	42.2	16 3	13 2
M	19751	2002	1940	166.0	52.2	12 9	13 5
F	399	1252	1244	163.5	52.6	18 7	15
F	20229	1383	1406	166.2	87.5	13 9	14 8
F	364	1403	1421	166.4	90.0	14 3	15 2
F	17348	1755	1747	163.0	60.1	19 4	15 3
M	360	1243	1230	157.2	42.6	18 5	14 9
M	27690	1658	1587	162.1	53.9	12 5	14 8
M	409	1715	1630	165.4	57.1	12 11	15 2
M	17353	2162	2212	179.0	57.9	18 7	15 1
F	396	1602	1602	159.0	56.3		16 7
M	373	1842	1826	174.0	57.9		16 11
M	20080	2435	2449	177.9	67.0		17 4

(Table Concluded)

Sex	X-ray number	Right area	Left area	Height	Weight	Mental age	Chronological age
F	443	0	0	58.4	5.04		2 mo. 24 da.
M	438	0	0	59.0	5.7		2 7
M	416	7	6	58.5	4.9		3 2
M	115	31	30	57.9	4.6		4
F	none	19	19	62.3	5.6		6
F	132	27	26	64.0	6.6		6 3
M	114	8	11	73.2	8.7		8
M	417	42	44	71.0	10.1		8 7
F	134	57	51	75.0	9.7		1 yr. 3 mo.
F	412	30	28	70.0	7.8		1
M	415	65	64	79.7	10.7		1 3
M	423	30	30	75.0	9.7		1 1
F	122	59	56	78.6	9.7	2 yr. 6 mo.	1 7
F	8	69	73	82.5	10.9		1 11
F	125	93	94	89.4	12.5		2 1
M	419A	23	20	84.6	13.3		1 10
M	50	72	68	87.0	12.7		2 3
F	25805	94	97	92.2	12.6	3 11	3 4
F	3	151	159	100.0	15.7		3 5
F	23920	226	201	105.6	16.3	4 2	3 5
M	27121	81	87	90.7	12.7	3 8	3 3
M	6	133	139	99.5	15.6	4 4	3 5
M	25806	190	187	94.6	16.3	3 10	3 2
F	25803	152	172	106.1	16.8	5 7	4 7
F	24336	211	212	105.9	18.6	5 6	4 7
F	24336	276	267	110.0	20.2	6 6	5 2
F	23919	488	437	111.6	19.0	7	5 4
M	15	117	113	103.4	16.3	5 3	4 7
M	18248	216	234	108.7	17.8	6 10	5 3
M	23918	250	237	111.3	18.1	7 2	4 9
M	41	319	296	116.7	21.3	8 2	5 5
F	23044	340	325	111.2	17.1	5 10	7
F	224	748	691	123.8	24.5	7 5	7
F	20963	469	459	122.2	20.1	7 6	6 8
F	98	506	494	124.5	21.8	8	7 2
M	85	217	215	122.5	23.5	7 11	6 7
M	27404	346	381	115.5	21.0	7 6	6 11
M	87	417	445	119.2	22.5	8 1	7 6
M	82	693	656	125.0	28.6	8 5	7 1
F	24339	553	459	128.2	20.6	9 4	8 7
F	241	719	708	135.1	26.8	10 3	8 9
F	256	748	764	122.7	22.5	10 7	9 1
M	27438	464	484	125.4	25.6	10 8	8 7
M	204	658	664	132.7	30.6	11 1	8 9
M	17001	732	746	134.4	28.2	9 8	8 7
M	236	812	820	137.2	30.7	10 4	9 1
F	277	821	799	131.9	32.8	10 5	10 9
F	259	1015	976	139.5	33.1	11 6	10 7
F	278	1447	1419			12 5	11 4
M	287	735	716	135.5	30.1	14 3	10 8
M	27674	1008	992	143.6	36.0	12 3	11
M	16791	1412	1418	157.0	39.9	16 11	11

Blood chemistry change in patients who have been treated with cod liver oil and quartz light for a period of three weeks.

H. H. (female)

	Normal	Date, 10-5-25	Three weeks on cod liver oil and quartz light. Date, 11-23-25
Phosphorus	5	3.66	3.90
Calcium	9-11	7.92	10.44

(Table Concluded)

	Normal	Date, 10-5-25	Three weeks on cod liver oil and quartz light. Date, 11-23-25
Calcium x phosphorus.....	40	29.0	40.7
Hydrogen concentration	7.35-7.43	7.47	7.38
Carbon dioxide	50-65	64.0	55.0
Ears			No change

C. W. (male)

	Date, 11-5-25	Three weeks without cod liver oil and quartz light. Date, 12-2-25
Phosphorus	3.69	3.57 mg. per 100 c.c.
Calcium	8.92	10.0 mg. per 100 c.c.
Calcium x phosphorus.....	32.9	35.7
Hydrogen concentration	7.35	7.33
Carbon dioxide	69.0	54.0 Vol. %

No.	Calcium	Normal (?) Phosphorus	Calcium x Phosphorus
1.	10.9	3.16	34.4
2.	11.35	4.16	47.2
3.	8.36	3.85	32.2
4.	10.8	4.11	44.4
5.	10.6	4.95	52.4
6.	11.2	5.41	60.5
7.	11.0	3.66	40.2
8.	11.1	2.76	30.6
9.	10.8	1.89	20.4
10.	9.71	6.66	64.6
11.	11.12	4.74	52.8
12.	11.73	3.26	38.3
Totals	128.67	48.61	518.0
Average	10.72+	4.05+	43.1+

If 8 and 9, distinctly low in phosphorus,
be omitted:

Totals	106.77	43.96	467.0
Average	10.677	4.396	46.7

"CYCLIC VOMITING" IN INFANTS AND CHILDREN¹

INCLUDING AN ANALYSIS OF THE OCCURRENCE OF VOMITING IN TWO HUNDRED
CHILDREN EXAMINED ROENTGENOLOGICALLY

By LEON T. LEWALD, M.D., Professor of Roentgenology, New York University

THE term "cyclic vomiting" is frequently encountered in pediatric literature and often appears to be applied to cases in which the vomiting is not periodic, so that some other term such as "recurrent" or "reflex vomiting" would be more accurate. The earlier descriptions of cases of cyclic vomiting were published long before the advent of the roentgen ray. Gruère (1) was one of the first to describe this condition, in an article published about 1840. Since then, systematic use of the roentgen ray in the examination of digestive disturbances in infants and children has thrown considerable light on the subject. In our experience in the examination of several hundred children, the cases of cyclic vomiting have usually been associated with lesions outside of the stomach itself. Hence the term "reflex vomiting" would be an advisable term to apply to this type of case.

Griffith (2) called attention to the incorrectness of the term "cyclic" and suggested substituting for it "recurrent," since "the word 'cyclic' implies a certain regularity which is not a characteristic of the disease." Marfan and other French authors called the condition "acetonemic vomiting." A number of other authors have considered the condition as a manifestation of acidosis. On the other hand, a number of pediatricians had about abandoned the theory when a recent contribution along this line was presented by Dr. S. A. Levene (3) under the title "Ketogenesis in Children as Compared with Adults." Levene has worked out an elaborate formula² regarding the relation-

ship between fatty acids and glucose, and the production of ketosis in children. So the question of the relationship between acidosis and cyclic vomiting has been reopened. Edsall and Pearson (4) state that they believe in acidosis as a cause for cyclic vomiting.

Comby (5), in 1905, thought that the vomiting depended in many instances upon chronic appendicitis. Dr. Mefford Runyon (6) considered chronic appendicitis as a cause for cyclic vomiting, and reported a group of cases. Dr. McGuire Newton (7) has expressed himself as convinced that chronic appendicitis is a competent cause for the condition, and gives great credit to the value of the roentgen ray in making a differential diagnosis.

The latest contribution is by Dr. A. L. Gray (8), who read a paper before the American Roentgen Ray Society in September, 1925, in which he reported a group of cases where removal of the appendix was followed by immediate relief, and he calls attention to the inaccuracy of the term "acidosis" in relation to cases in which the presence of chronic appendicitis is, in his opinion, the cause for the vomiting. Gray calls attention to the *absence* of pain or distress in the region of the diseased appendix in children. He also emphasizes the value of the roentgen-ray examination in children in an effort to establish the presence of a non-acute pathological condition of the appendix and lays particular stress on the "inability to *exclude* disease of the appendix by roentgen-ray examination." On the other hand, in a recent textbook on pediatrics the only reference to vomiting in relationship to appendicitis is mentioned under attacks of *acute* appendicitis. An unusual group of cases is referred to by the same author, in

¹Read before the Eleventh Annual Meeting of the Radiological Society of North America, Cleveland, Ohio, December 7-11, 1925.

$$\frac{2 \text{ Fatty Acids}}{\text{Glucose}} = \frac{(0.46 \times P) + (0.9 \times F)}{C + (0.58 \times P) + (0.1 \times F)} = \frac{F. A.}{G.}$$

which tonsillar infection is regarded as the important factor in cyclic vomiting, and he says: "Unless it be the rheumatic syndrome, there is no other clinical entity so closely associated with tonsillar infection as is periodic or cyclic vomiting."

Fenwick (9) has so well described the clinical course of the condition that he is quoted in full as follows:

"Under the various titles of 'periodic,' 'fitful,' 'recurrent,' and 'cyclical' vomiting, different writers have described a disease of childhood characterized by severe attacks of emesis, which exhibit a tendency to periodic recurrence. Cases of this description are extremely common in practice, and are in reality merely examples of a variety of gastric catarrh, which in certain individuals has a tendency to recur from slight and ill-defined causes. In some instances a tendency to the complaint appears to have been transmitted from parent to child for several generations, but in others no such history can be obtained, although several members of the family may have suffered from the disease in early life. The disorder usually commences between the ages of two and five, and, according to my experience, is more common in boys than girls. In some cases the first attack appears to follow exposure to cold or indulgence in some special article of food, while in others the disease originates spontaneously during the convalescent period of some infectious fever, such as measles or scarlatina; but whatever the original cause may have been, the complaint, when once established, exhibits a peculiar tendency to recur at short intervals, and without apparent reason. In some children, however, any slight disturbance, such as fatigue, anger, a change of diet, or even a shift of the wind toward the east, is immediately followed by the symptoms of the disorder.

"Although the attacks exhibit a certain periodicity of recurrence, it must not be supposed that they develop at regular intervals of time. On the contrary, the disorder is usually extremely uncertain in its onset, at one time recurring once or twice a week, while at another several weeks, or even months, may elapse between the consecutive attacks. As a rule, the most obstinate and severe cases are those which date their origin from the convalescent period of measles or typhoid. In such instances a month rarely passes without an attack being witnessed, while in many cases two, or even three, may occur within the same space of time. With the approach of puberty, the incidence of the disease becomes less and

less frequent; but even after this age the subjects of this disorder are prone to develop catarrh of the stomach from trivial causes.

"In its clinical aspect this variety of gastric catarrh does not differ materially from the acute form already described. It commences at any time of the day, more especially in the early morning or after the midday meal. As a rule, nausea and vomiting are the first symptoms to attract attention, but occasionally the child suffers from headache or abdominal pain for several hours before the emesis commences. The face is pale, the pulse small and feeble, and occasionally dimness of vision and giddiness are complained of. The first effect of the vomiting is to rid the stomach of the remains of the last meal, which from its large quantity and undigested appearance affords conclusive proof that the motorial and secretory functions of the organ had been in abeyance for some time. Further examination shows that the material is either neutral or faintly acid in reaction, and that hydrochloric acid is absent. Occasionally I have detected traces of lactic acid in the vomit, but this is seldom present unless the food has undergone stagnation for several hours. Although the first act of emesis may afford temporary relief, the sensation of nausea soon recurs, and is followed by severe retching. From time to time small quantities of mucus mixed with saliva are ejected and occasionally streaks of blood may also be observed. In severe cases the vomit may consist entirely of bilious fluid. During the course of the disorder the bowels are confined, and the tongue presents a uniform coating of thin white fur. Between the attacks of retching the child exhibits mental and physical depression of a severe kind, and lies motionless upon the bed, apparently unable even to turn over or lift up its head. Nevertheless, there exists but little danger to life, for recovery takes place rapidly as soon as the gastric intolerance subsides. In the vast majority of cases the temperature of the body remains subnormal as long as the vomiting persists; but occasionally, and especially in children debilitated by previous disease, a slight degree of fever may be observed toward evening.

"It is seldom that any special nervous phenomena accompany an attack, but in more than one case I have known strabismus, associated with intolerance of light, to lead to the diagnosis of meningitis.

"The duration of the disorder varies in different cases, the extreme limits being two hours and three days. Recovery is usually rapid, but between the attacks the child remains pale, thin, and irritable, and often suffers from want of appetite, with constipation and clay-colored stools."

In our experience (10) the history of recurrent attacks of vomiting in infants and children is so common and the roentgen-ray findings so various that *no one condition* is so constantly present that it alone may be designated as the producing cause (Tables I and II). The vomiting, as a rule, however, does *not* appear to be directly related to pathological conditions in the stomach alone, but frequently is associated with abnormal conditions in other portions of the digestive tract.

TABLE I
CYCLIC VOMITING
Analysis of 44 Cases

Age	No.	M.	F.
First year	1	1	
Second year	2	1	1
Third year	4		4
Fourth year	5	2	3
Fifth year	6	5	1
Sixth year	9	4	5
Seventh to tenth years	11	4	7
Eleventh to fifteenth years	6	3	3
Totals	44	20	24

TABLE II
CYCLIC VOMITING
Analysis of 44 Cases

History of "acidosis".....	10
History of convulsions.....	4
History of previous removal of appendix without relief.....	2
Roentgen-ray Findings in 44 cases:	
Dilated, ptosed stomach.....	23
Pylorospasm.....	8
Gastric retention.....	11
Pyloric stenosis.....	1
Dilated cecum.....	7
Sluggish appendix.....	7
Incompetent ileocecal valve.....	15
Redundant colon.....	35
Colonic stasis.....	12

Many cases showed more than one lesion, such as dilated stomach and redundant colon.

The following cases have been selected to illustrate some of the causes of cyclic vomiting.

Case 1. A. B., female, aged 15 years. Cyclic vomiting of *reflex origin associated with strabismus*. At the age of 12 years began to have vomiting attacks at irregular

intervals of from one to three months. Had tonsils removed a short time before the vomiting attacks began. Had diphtheria at age of 1½ years, at which time intubation was necessary on account of laryngeal complications. Had internal strabismus for which an attempt at correction had been made by wearing glasses, but without benefit. Roentgen examination of the digestive tract disclosed no marked abnormality. The appendix was somewhat sluggish. There was moderate redundancy of the pelvic colon and a slight tendency to dilatation and ptosis of the stomach. Appropriate treatment was directed to the gastro-intestinal tract, but vomiting recurred. On careful questioning it was ascertained that there were supra-orbital headaches. In view of the strabismus it was decided to correct this condition by operative procedure, which was successfully performed by Dr. John Wheeler at the New York Eye and Ear Hospital. The most striking improvement in her general health followed the operation and no more vomiting attacks occurred.

Comment: This is a striking example of a reflex condition remotely removed from the digestive tract which caused cyclic vomiting.

Case 2. C. L., male, aged 14 years, referred by Dr. Charles Gilmore Kerley. Cyclic vomiting present *after removal of appendix and associated apparently with an abnormally long pelvic colon*. Vomited every three or four months since early childhood. *Very constipated*. Appendix removed two years prior to present observation. Has had one of most severe attacks he ever had since removal of appendix. Roentgen examination showed definite evidence of gastropspasm and pylorospasm (Fig. 1 A). There was extreme redundancy of the pelvic colon amounting to about three times the anatomical length and associated with secondary dilatation of the right half of the colon and cecum (Fig. 1 B). Treat-

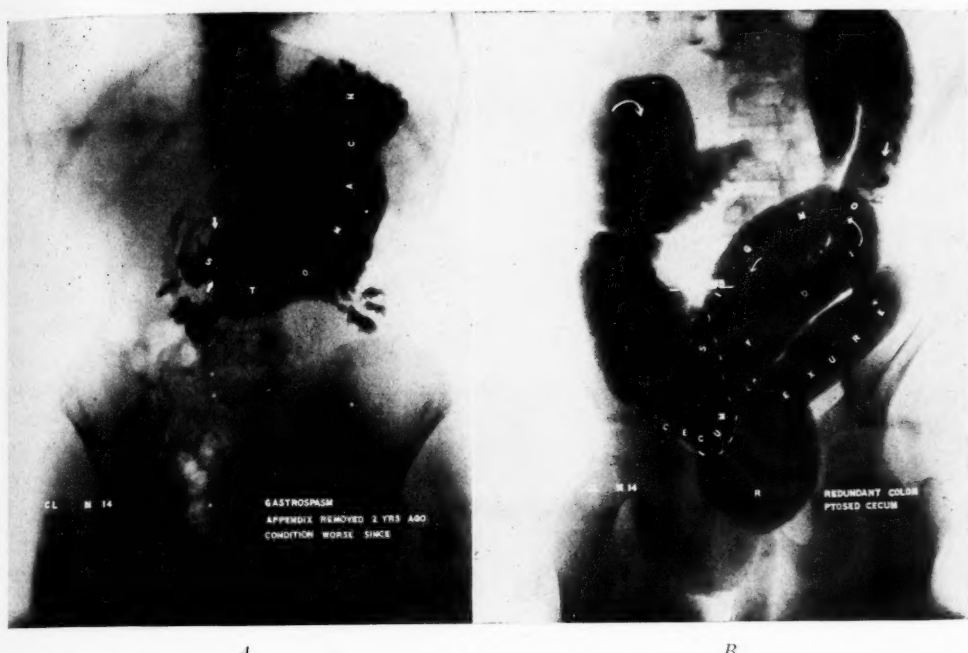


Fig. 1, Case 2. Cyclic vomiting due to gastrospasm (A) of reflex origin from colonic redundancy and dilatation. In this case the appendix had been removed two years previously without relieving the recurrent attacks of vomiting. For appearance of colon in this case see (B).

(B) Extreme redundancy of the "pelvic colon" which extends three inches above the iliac crests. Secondary dilatation of the right half of the colon and of the cecum, associated with gastrospasm and cyclic vomiting. (Male, aged 14 years.)

ment was directed to the abnormality of the digestive tract and an abdominal belt was applied. The vomiting attacks ceased and the patient gained seven pounds in weight in five weeks.

Comment: This case proves that cyclic vomiting can not be cured by removal of the appendix, unless it is shown by roentgen examination and clinical symptoms to be definitely diseased and not associated with abnormal conditions of the digestive tract.

Case 3. M. B., female, aged 5 years, referred by Dr. Charles Gilmore Kerley. Had recurring attacks of vomiting since one year of age. The earlier attacks were associated with fever. The diagnosis of "acidosis" had been made prior to the time that Dr. Kerley saw the patient. Roentgen examination revealed *extremely dilated stomach associated*

with pylorospasm. The greater curvature of the stomach in the standing position extended 1 inch below the level of the iliac crests (Fig. 2 A), and a roentgenogram made in the prone position showed the stomach extending entirely across the upper portion of the abdomen, reaching the abdominal wall on the right side (Fig. 2 B). There was retention of at least a sixth of the meal at the end of six hours. The colon was unusually long and there was moderate dilatation of the pelvic portion and of the rectum.

Comment: This case illustrates the common error of considering cyclic vomiting due to acidosis before roentgen examination has been made. The extreme dilatation of the stomach and pylorospasm, and associated abnormality of the colon, offer indications

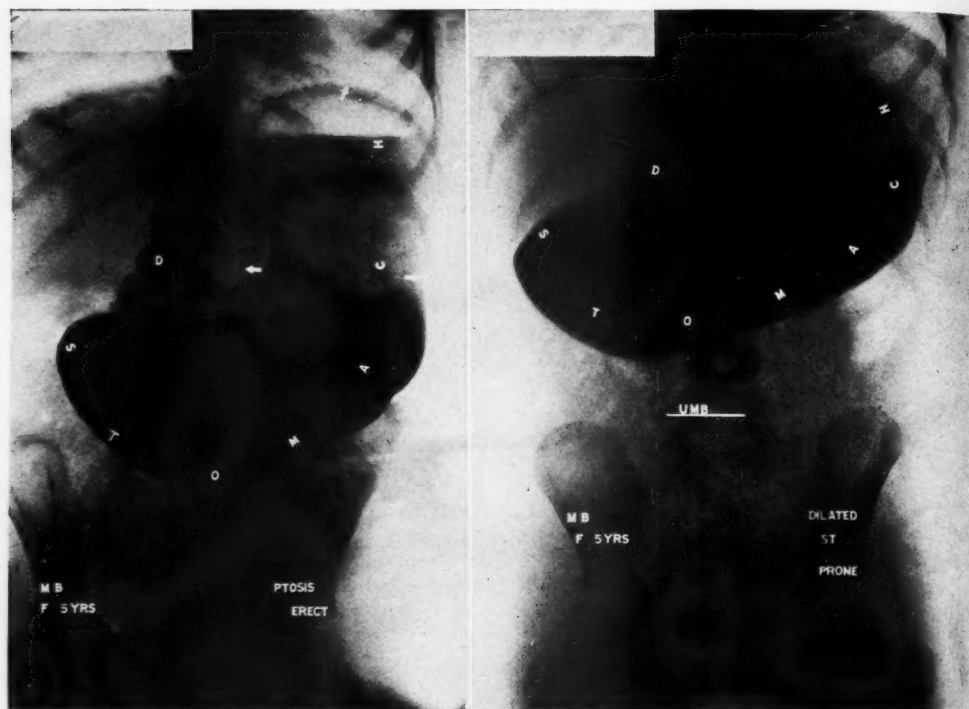


Fig. 2, Case 3. Cyclic vomiting associated with ptosis of the stomach (A) in which previously an erroneous diagnosis of "acidosis" had been made.

(B) Radiograph made in prone position. Note the extreme dilatation of the stomach which extends completely across the abdomen. There is also evidence of pylorospasm. At six hours there was retention of a sixth of the meal. (Female, aged $5\frac{1}{4}$ years.)

for treatment based upon definite pathological conditions.

CONCLUSIONS

1. In a series of about two hundred infants and children referred for roentgen examination on account of chronic disorders of the digestive tract, a history of recurrent or cyclic vomiting was obtainable in at least one-third of the cases.
2. The cases were nearly equally divided as to sex.
3. A previous diagnosis of acidosis had been made in at least 20 per cent.
4. The predominant roentgen findings related to the colon, particularly redundancy.
5. Pylorospasm, dilatation of the stomach, and ptosis of the stomach were frequent additional findings.
6. Roentgen evidence of chronic appendicitis sufficient to warrant operation was encountered in only a very few instances. The appendix should never be removed for supposed chronic appendicitis without a thorough roentgen examination of the digestive tract in order to exclude other abnormalities, or to obtain confirmatory evidence of chronic appendicitis and to find the exact location of the appendix. Forty-eight cases of left-sided appendix have been found on roentgen examination by the author, associated with either complete transposition of the viscera or non-rotation of the colon (11).
7. In two cases the appendix had been removed previously *without* relief.
8. In one case in which the gastrointestinal tract was negative, operation for

correction of internal strabismus cured the vomiting attacks.

9. Cyclic vomiting is not an entity, and has no specific cause.

10. Cyclic vomiting is probably of reflex nature and usually is associated with abnormalities in some portion of the digestive tract.

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THE THYMUS IN THE NEWBORN AND EARLY INFANCY¹

By G. J. NOBACK, M.A., Ph.D., Assistant Professor of Anatomy, New York University and Bellevue Hospital Medical College, New York City

IN 1921, the writer (1) reported results of a study of the thymus in the fetus and newborn child which was concerned with the form and relation of this organ and how these were modified by the establishment of respiration. This work led to the following conclusions:

1. The thymus in the last half of fetal life is broader than long, has laterally bulging sides, is not overlapped by the lungs, usually extends into the neck and does not extend inferiorly over the ventricle.

2. Extension of thymus substance in the posterior direction was present in 7 per cent of the individuals studied. These posterior projections in some cases partially or completely surrounded the innominate vein and superior vena cava, in others the aortic arch and innominate artery were compressed, and in some the thymus pressed upon the trachea with a resultant constriction in this structure.

3. The broad, convex-sided type of thymus described for the fetus is also found to be present in full-term stillborn infants.

4. With the initiation of respiration and the resultant expansion of the lungs, pressure is exerted by these organs against the sides of the thymus. This pressure results in a narrowing of the thymus and is evident in children that have lived but half an hour. With increasing expansion of the lungs and thus increase in pressure upon the sides of the thymus, a flattening of the convex sides occurs and later deep depressions are developed. Along with this narrowing of the thymus, there occurs an elongation of this organ and it is extended inferiorly over the surface of the heart.

The outline of the thymus in the late fetus and in the stillborn child is similar to

that described by many roentgenologists as "enlarged" or "hypertrophied." In these latter it seems we have normal glands which as yet have not been fully narrowed by the lungs. It is quite probable that some thymi may retain this broad type for several years and yet not be pathological.

In 1913 Friedlander (2) stated: "There does not appear any question as to the diagnostic value of the X-ray in many cases of enlarged thymus. But even as experienced a radiographer as Lange expressly insists that in certain cases, especially if the gland be increased in size laterally without augmentation of its posterior diameter (the large flat thymus), the X-ray picture may not be conclusive." Crotti (3), in 1913, reported an "enlarged" thymus outlined by percussion 2 cm. to the left and 2.5 cm. to the right of the sternal edge. This organ pressed upon the pulmonary vein, the aorta and the trachea so that the latter was flattened. He ascribed death in this case to abnormal enlargement of the thymus.

Blackfan and Little (4), 1921, radiated 60 children, aged between 5 hours and 1 year, who were normal as to the thymus. They reported the thymus to be "enlarged" in 48 per cent of their series. They say, however: "Whether this shadow should be interpreted as an enlarged thymus or whether it should be regarded as normally occurring in a certain percentage of normal infants cannot be stated at the present time. We have been unable to find any points of differentiation between the roentgen-ray shadow found in patients with clinical symptoms of enlarged thymus and the shadow in 'normal infants.'" They treated six infants who presented clinical signs of an enlarged thymus. The roentgenogram revealed a shadow indicative of enlarged thymus.

¹Read before the Radiological Society of North America, at Cleveland, Dec., 1925.

Roentgen-ray treatment resulted in an improvement in clinical symptoms and the shadow disappeared.

Evans (5), 1922, stated that the thymus was enlarged in cases of faulty respiration and that he believed this to be a factor in asphyxia neonatorum.

Greenthal (6), in 1922, radiated, for various reasons, 351 children between 3 days and 12 years of age. He reported thymic enlargement in 25.6 per cent of this group. He cited one case which by X-ray showed no thymic enlargement; however, at necropsy a hyperplastic thymus was found.

Liss (7), in 1922, in 119 normal infants at birth observed in 42 per cent the presence of a "large shadow" suggesting a thymus measuring more than 3 cm. and this without gross symptoms. He followed some of these cases with X-ray examinations at monthly intervals and reported that the greatest retrogressive change occurred in the first few months.

DeBuys and Samuel (8), in 1924, found in 450 X-ray observations of newborn infants and children between 6 months and 1 year in age that the thymus shadow did not gradually increase or decrease. They reported that it might vary in the same infant at different periods in the first year without any clinical evidence of disease.

Peterson and Miller (9), in 1924, after a study of 120 infants, concluded that "abnormally enlarged thymus" was common in the newborn, occurring in 40 to 50 per cent of such infants. They also reported "a definite fluctuation in the size of the thymus synchronous with respiration."

cent it was found that the thymus extended posteriorly so as to encroach upon the subjacent structures.

Roentgenological studies as reported in the literature show that the observers find "enlarged" thymus glands *without clinical symptoms*. The frequency of these observations varies. Liss finds 42 per cent in the newborn; Greenthal finds 25.6 per cent in children between 3 days and 12 years. No doubt his percentage is low due to inclusion of older children. Blackfan and Little report 48 per cent and Peterson and Miller 40 to 50 per cent.

Clinical observations supported by necropsy findings show that the thymus may compress the subjacent structures.

Does all this not indicate that the problem is really one of anteroposterior extent of the thymus rather than one of its width? LeWald (10) has observed a pair of twins 9 months old, in which each showed an enlarged thymus. A subsequent pair (2 years 3 months) showed similar enlargements in each. The significant fact is that in one only of each pair were there symptoms which pointed to the thymus. May not the explanation be that those with symptoms had thymi which projected posteriorly and thus involved the posterior structures? It does not seem correct to diagnose the broad-shadow thymus as "enlarged" or "hypertrophied" when it is but slightly less frequently found than the narrower-shadowed thymus. And how are the designations "enlarged" and "hypertrophied" justifiable in the absence of clinical symptoms?

DISCUSSION

Anatomical findings demonstrate that the broad type of thymus is characteristic in the late fetus and in the stillborn child. This broad thymus is gradually molded by the expanding lungs, following birth. In 7 per

CONCLUSION

The broad-shadow thymus is probably as "normal" as the narrower one in the absence of clinical symptoms or knowledge that the thymus compresses the structure posterior to it. Symptoms pointing to the thymus

seem to indicate roentgen therapy *regardless of the width of the thymic shadow*.

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DISCUSSION

DR. W. WALTER WASSON (Denver): This symposium on children has been constructed with the definite purpose of enlisting and stimulating the interest of this Society in children. Unfortunately, two of the men who were to take part, Dr. Carmody and Dr. MacRae, could not be here, but I am sure the other men will give plenty of material of interest. In looking over programs, and so far as my memory goes, it is rather interesting to note that this is perhaps the first symposium on children in this Society, and few other societies devote much time or attention to children. The program of a meeting held a few weeks ago, starting at seven o'clock in the morning and running until eleven o'clock at night for five days of the week, had three papers on children. In other words, the medical profession, it seems to me, are devoting most of their time to the

adult, and there are plenty of reasons to explain this. The adult is the one who comes to us and demands attention. The adult is the one who has the money. The adult is the one who has been the easiest to examine. So it has been in the history of medicine; we have done, as a general rule, the easiest thing first. In other words, as I look back with my rather short knowledge of radiology, it seems to me that we have jumped into the midst of adult disease and have rather feverishly tried to account for various things that we find in our X-ray examinations. We have met with great success in this investigation, but many things we do not understand. To-day we have at hand practically all the instruments necessary for a complete study, every means for precision, and it is time we were making a complete study. By a complete study I refer to an investigation of the anatomical, physiological and pathological changes from infancy to adult life, and in the same individuals. Such an investigation must be correlated with the parentage, the habits and the environment of the individual, and in the serial examinations the X-ray must play a leading part. The radiographs of any one person, when placed together, would make a record from infancy to adult life which would be instructive and of which we could well be proud.

The examination of children in the past has been difficult and a great many times has failed because we did not have the facilities. I think we now have those facilities and under a proper systematic investigation, well correlated, I believe the results would be enlightening. This investigation will probably have to be taken up by the younger men, as it will have to extend over a long period of years and consist essentially of serial examinations, but it should be guided by the older men and it should be conducted especially in medical institutions where they can keep careful record of their investigations, where this material may be filed away,

and where it may be handed down for future generations and for teaching purposes. As I look at it to-day—and I have become interested in the matter only by chance—I do not see how we can have any true knowledge of adult pathology without a knowledge of child pathology. Certainly our adult pathology a great many times starts in infancy; we have the general constitution beginning at that time; we even have the germs planted at that time. Dr. Carmody would have shown you, if he had been here, the tremendous amount of infection we have in the sinuses, beginning in infancy, even at a few months of age, and other investigators have found the same thing. The same is true of the chest and the same is more or less true of the gastro-intestinal tract. I therefore beseech your interest in this matter.

DR. W. E. CHAMBERLAIN (San Francisco): We are indebted to Dr. Noback for his very timely demonstration in connection with thymic enlargement. His observations fit in very exactly with our experience in the roentgenological diagnosis of this condition.

For the past five years our routine X-ray examination of the child's chest has included a lateral view. At first the lateral views were very difficult to interpret, but after we had seen a few hundred of them they became full of significance, and I think I am safe in saying that we obtain at least as much information from the lateral, in the average case, as we do from the anterior projection. And in the diagnosis of significant thymic enlargement, the lateral view is much more important than any other.

In the first place, a thymus may be quite wide (and therefore appear large in the posterior-anterior view) without producing symptoms, but when it is enlarged in its anterior-posterior dimension, it soon produces pressure effects. Some of Dr. Noback's anatomical material brings out this

point very beautifully. And the lateral view, by demonstrating even very slight degrees of backward displacement of the trachea, gives us a very definite index of *significant* (as distinguished from less important) thymic enlargement. In order to read these lateral films it is necessary to be familiar with the normal, especially in the matter of location of the trachea.

Another point deserves emphasis. The thymus is a highly vascular organ, and, situated as it is within the thorax, it is capable of gross changes in its volume caused by changes in (a) position of patient (the thymus is larger in the prone than in the erect position); (b) phase of respiration (the thymus is larger at full expiration and smaller at end of inspiration); (c) intrapulmonary air pressure (inspiratory effort against a closed glottis produces marked increase in volume of thymus by markedly increasing its blood content, while exactly the opposite occurs with expiratory effort).

At first glance this last point might appear unimportant. On the contrary, and especially in children, it is of the greatest importance. It frequently happens that X-ray examination of a little child is made under just the conditions which can cause a normal thymus to appear enlarged. The conditions referred to are those present when the exposure is flashed at the end of a cry. At this instant, just before the little inspiratory crow which marks the reopening of the glottis, both the phase of respiration and the intrapulmonary air pressure are so disposed as to give maximum blood content in all of the intrathoracic organs.

DR. J. F. HERRICK (Ottumwa, Iowa): In connection with what the last speaker said, I would add a word. In 1913 or 1914, I did a little work on the thymus, and one of the striking things I observed was the displacement of the trachea in the lateral film. This was sufficiently marked so that

it stood out. The entire contents of the chest, the large blood vessels and trachea were pushed backwards toward the spinal column. In one case, a child three and a half years old, who died in a thymic attack, on whom I made a postmortem, the immediate cause of death in my judgment was not the pressure on the trachea or on the large vessels, but the pressure of a very large thick fleshy part of the thymus on the right auricle. The Doctor spoke about the trachea standing out so beautifully. It does; it may be diagnostic. A transverse chest plate gives a very correct idea of the distribution of the organs of the chest, and I think is a ready means of determining the depth of the thymus.

DR. H. J. ULLMANN (Santa Barbara, Calif.): I was much interested to hear Dr. LeWald speak on the incompetent ileocecal valve. I would like to ask him if he considers this less frequent in children than in adults, because I think that we have come to believe that a barium enema passing the ileocecal valve is more or less an ordinary occurrence in adults.

I was glad to hear Dr. Chamberlain emphasize the technic. We have not taken any thymuses for some time with a child prone or supine. There is a tremendous difference, and we have tried to make it a practice to take the child during the time that he is sobbing or crying, and catch him during the pause. I was glad to hear Dr. Chamberlain bring out the necessity for taking children upright. We have had a series of thymuses sent in lately, of children with mild clinical symptoms. In fact, one pediatricist asked me if I would, as a matter of help, take all the difficult feeding children and inspect their thymuses because of two or three who had symptoms pointing to thymus pressure. The predominant symptom in these cases was difficult feeding. They had moderately enlarged thymuses and

showed marked improvement within a week following the first irradiation.

DR. LEWALD (closing): In answer to Dr. Ullmann's question—it is stated by some authors that there is more likely to be incompetency of the ileocecal valve in the child than in the adult. Personally I would say that the proportion is about the same, or less in children; it is a difficult thing to state with accuracy. Most of the children we have seen have had, of course, pathological conditions of the large bowel. It would be interesting indeed if somebody would do a series of normal children to determine that particular point.

Dr. Ullmann's second remark in regard to relief of the difficulty found by treatment of the thymus gland, I think is well founded. In a group of cases reported in Cincinnati, they even relieved cases of so-called congenital hypertrophic stenosis. I happened to be in Cincinnati at a medical meeting and I was taken out to the General Hospital and shown these cases of what would go ordinarily as congenital hypertrophic stenosis, in which they showed thymic shadows, used X-ray treatment, and relieved the vomiting.

DR. NOBACK (closing): I do not think I have anything to add in the way of comment on the thymus, but I would like to say a few words about the anatomy of children. I was glad to hear Dr. Bundy Allen's paper, for I know they are doing great work on children at the University of Iowa. The need of more anatomic knowledge of children may be indicated by several things markedly differing from the adult condition we know at the present time to exist; for instance, the patella does not ossify until between the third and fifth year; the temporal bone is separated into several parts at the time of birth. The development of the sinuses—I looked forward to hearing the paper on infections of the sinuses. I am

sorry the speaker on this topic was absent, but the history of these as we know it today is interesting. For instance, the maxillary sinus and the ethmoidal sinus may be recognized as beginning early in fetal life,—the third and fourth months. However, at birth the maxillary sinus is pretty well developed, and, as Davis and Schaeffer have pointed out, has a rapid growth coincident

with the growth of the maxilla and the eruption of the teeth, so that up to eight years of age we have an increase of three millimeters in longitudinal diameter and two millimeters in the other diameters each year. I hope that some of the roentgenologists will take a greater interest in the anatomy of infancy and give us what dissection alone cannot.

Investigations on the influence of back-scattering.—This paper reports a number of measurements carried out by means of the Siemens dosimeter to determine the causes for the discrepancies which exist between the findings of various investigators. To quote the authors, they cover the following points: "(1) The change of the surface dose with changes of the size of field, using different qualities of radiation; (2) the amount of radiation scattered back from the water phantom for different sizes of field; (3) the magnitude of the ionization current in a small ivory ionization chamber used in our experiments, and the relation of this ionization current to the physical and biological dose, and (4) the significance of the back-scattering for standardization of the roentgen-ray dose."

Among the conclusions reached are the fol-

lowing: "Experiments showed that it is advisable when calibrating different machines, different tubes, etc., to have the ionization chamber freely suspended in air. The use of the 'roentgen value' as expressed by Holthusen is strongly recommended. To measure erythema doses, however, the chamber ought to be placed there where the erythema is produced, i.e., on the skin of the patient."

The "roentgen value" referred to, as defined by Holthusen, is "the number of R-units which the radiation delivers per minute at a focal distance of 30 cm. without additional scattered radiation."

The Influence of Back-scattering upon the Surface Dose in Roentgen-ray Therapy. Otto Glasser and George S. Reitter. Am. Jour. Roentgenol. and Rad. Ther., July, 1926, p. 43.

A NEW TYPE OF FLUORESCENT SCREEN

By I. SETH HIRSCH, M.D.

THE recording media at present utilized in examinations with the X-rays are the sensitive silver emulsion and the fluorescent screen. The former gives a permanent, indelible image, and the latter a transient and evanescent one, which disappears when the energization of the tube ceases. It seemed desirable for many reasons to possess a means by which the fluorescent image might be retained for prolonged intervals, hours if necessary, after

longed period, and discovered a method of reviving the image, when it has almost completely faded from view.

SCREEN

The screen consists of a fluorescent emulsion which may be spread, as usual, on paper, or on any other surface permeable to the radiation, such as aluminum, silver, etc. If the screen hitherto in use is such as gives

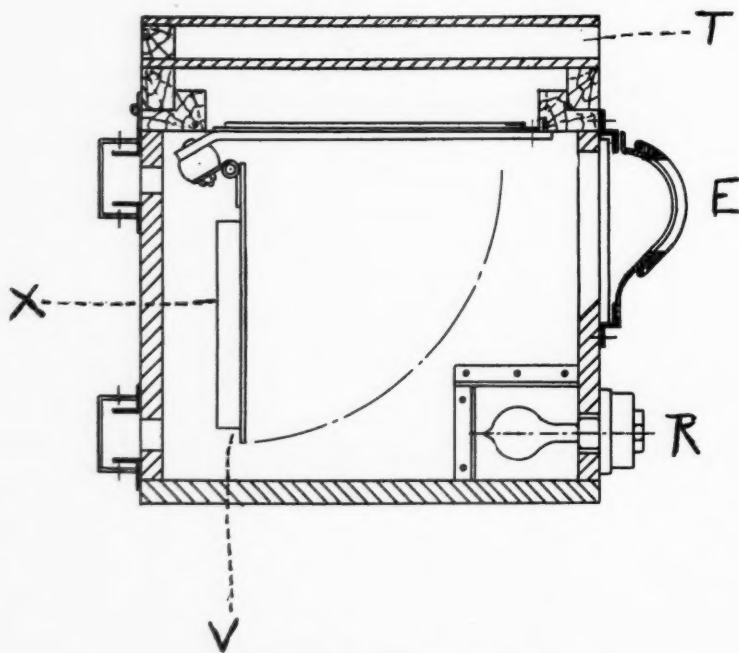


Fig. 1. See description in text, page 423.

the energization of the tube. Such a device could be applied, and utilized in many ways as an aid in the various radiological diagnostic procedures.

To this purpose, I devised a fluorescent screen which retains the image for a pro-

longed period, and discovered a method of reviving the image, when it has almost completely faded from view. The screen I have devised may be considered as giving a maximum fluorescence and maximum after-fluorescence, thus permitting reference to the image at any time, and a trans-

ference of this image away from the point of energization of the tube. Besides this, the fluorescence of the emulsion may be in-

lucida"), the screen may be viewed after exposure in the same room, in the box arrangement, with the part of the body *in*

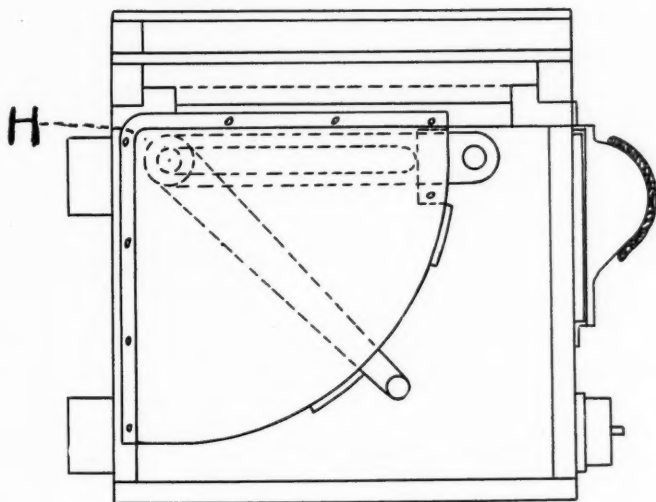


Fig. 2. See description in text, this page.

tensified by the application of heat and thus an image which, with time, has almost faded, may be revived.

CONTAINER

The screen may be inserted in a regular film holder or in a box, or in a frame, or in any other contrivance. The exposure with the body in the desired position is made in the usual way. If the screen has been placed in a regular film container or holder, it may be taken to the dark room, and there viewed. One or more radiographs (positives) may be made from the fluorescent image by applying a film in a cassette to the surface of the fluorescent emulsion for several seconds.

In the apparatus as shown in the accompanying illustrations (a sort of "camera

situ, thus serving the same purpose as does a "finder" on a camera.

The box (Fig. 1), of any convenient size, may be placed within a table so that the top of the box serves as part of the table top. On this the usual tunnel plate changer (T) is placed. By placing the part and the tube in the position desired, an exposure may be made on the screen with the lever in position (Fig. 2, H). The screen is then by means of the lever dropped from the horizontal position to the vertical position (Fig. 1, V) and then is viewed through the eye pieces (Fig. 1, E). If the desired view is obtained and the anatomic relationships sought are visible in the particular set-up, a film is slipped into the tunnel and the regular examination made. If the view obtained is not the desired one, then by means of a red light (Fig. 1, R) the image may be obliterated and the screen is ready for

another exposure. If the image is faint, it may be intensified by turning on the switch, which controls an electric heating element (Fig. 1, X) in contact with the screen. This increases the brilliancy of the illumination.

Another method of usage is to insert the screen in the old-fashioned pyramidal viewing box, as shown in Figure 3. The box is placed in position with the screen in contact with the part, and an exposure made. The eyes are then applied to the hood, and the image viewed with the heating element in contact with the screen, if necessary. This method may be utilized in the search for foreign bodies, for the viewing of fractures, etc.

For kidney examinations at the operating table this method readily replaces either the fluoroscopic or radiographic methods now utilized. When the kidney has been partially delivered and it becomes important to know the position, number and size of the calculi, the fluoroscopic examination with the usual screen necessitates exposure during the entire examination. Under the best circumstances this examination at the operating table is difficult, and, for obvious reasons, dangerous. The film examination of the partially delivered kidney is objectionable in that the development of the film takes an appreciable time before it may be viewed. The examination is much simplified by the use of this screen.

For this purpose, a small hand fluoroscope has been devised, with a removable front which consists of a small metal photo-

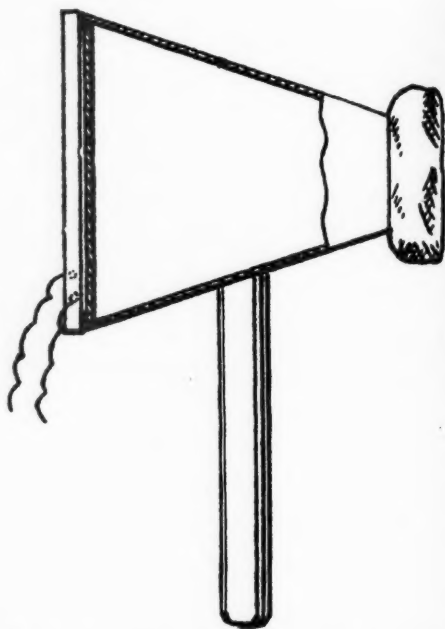


Fig. 3. Pyramidal viewing box with heating element attached, which is shown in position for warming the screen. Before illuminating the screen the heating device is swung away.

graphic film holder, $3\frac{1}{4} \times 4\frac{1}{4}$, containing the screen. This, wrapped in sterile dressing, may be slipped under the kidney and an exposure made with a portable appara-

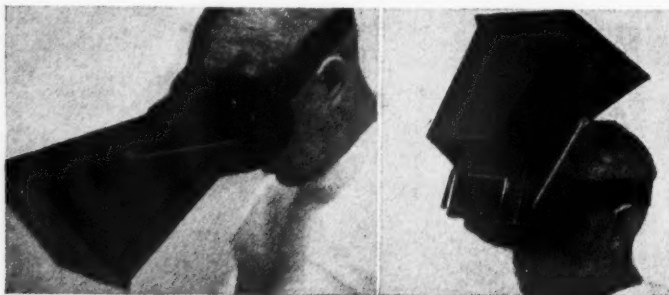


Fig. 4. Showing the application of the screen to the "operating" bonnet fluoroscope. The screen, which replaces the usual fluoroscopic screen, may be swung out of the line of vision when necessary.

tus. The holder is then slipped into a small pyramidal hood, the slide pulled out, and the image viewed.

Other applications of this screen to radiography are possible and readily suggest themselves.

Benign form of hemorrhagic nephritis.—The author says that most clinicians are as yet unacquainted with the benign form of hemorrhagic nephritis, the English and American literature containing "nothing more than extremely casual references" to it. During the last five years he has had fourteen cases. He summarizes as follows:

"The disease occurs most commonly in young adults and is characterized by a hematuria, usually macroscopic, which may be painless. Unlike the common form of the acute diffuse disease, there are usually no constitutional symptoms. Neither edema nor hypertension develops at any time during the course. The hematuria may be persistent or recurrent in the form of brief attacks. In most instances a definite focus of chronic infection can be discovered, usually in the tonsil. The elimination of such a focus, for example, by tonsillectomy, frequently results in a temporary but pronounced increase in the hematuria, followed by gradual but complete disappearance of red blood cells from the urine. Many of the cases are at first considered examples of hematuria due to surgical conditions in the genito-urinary tract. Some have undoubtedly

masqueraded in the past under the general term 'essential hematuria.'"

There are two types of the disease—recurrent and persistent, as stated above: in both the urine presents few changes aside from the macroscopic hematuria. Albumin is always present in variable amounts. The total volume of urinary excretion does not change. There may or may not be pain. "Sore throat usually precedes the onset of the hematuria in the recurrent type," the author says, "whereas in the more chronic persistent cases there may be little or no discomfort." The blood pressure usually remains normal, and edema has not occurred in the author's series.

He reviews the etiology, pathology, differential diagnosis, and prognosis, concluding with the report of a case, and the comment that "it is evidently important to be able to differentiate this group of benign focal hemorrhagic nephritis from the larger and more malignant group of acute diffuse glomerular disease."

A Benign and Curable Form of Hemorrhagic Nephritis. George Bachr. Jour. Am. Med. Assn., April 3, 1926, p. 1001.

RADIO-ACTIVE SUBSTANCES: THEIR THERAPEUTIC USES AND APPLICATIONS

RADIUM THERAPY IN RHINOLOGY

By JOSEPH MUIR, M.D., NEW YORK CITY

THE therapeutic application of radium has always been so closely associated with the idea of malignancy that the great majority are hardly aware that it is equally applicable to many benign conditions. In the treatment of lesions of the nose and its accessory sinuses, it has been found that in a variety of newgrowths which are clinically non-malignant, but in many instances highly resistant to all the surgeon's efforts toward extirpation, radium has provided a means of cure, or, at the least, marked amelioration, when every other previously known therapeutic agent had proved utterly impotent.

There is comparatively little in the literature concerning the radium treatment of rhinologic lesions, yet it is daily becoming more indispensable to those who devote themselves to surgery of the nose and the structures intimately connected with it. This is probably because, despite the great advance in every form of radium application, the majority of rhinologists still feel that the work has not yet passed beyond the experimental stage, and that any results they may be able to report must be regarded as more or less inconclusive. It has apparently been tried in a wide variety of nasal conditions, and in all some measure of success has been reported, but in many instances it is likely that the treatment was applied by those who had neither the fundamental knowledge nor the experience to give their patients the full benefit they might have derived from the therapy, and, as is always the case under such circumstances, the therapeutic agent has received the blame that should rightly have been laid upon the shoulders of the therapist who wrongly used it.

Thus two years ago we find Laura A. Lane listing a considerable number of benign conditions about the nose to which radium may be considered applicable, in which are included even hay fever and syphilitic lesions. There do not, however, seem to be any reliable reports in literature, or any testimony which has been presented before special societies, to warrant our becoming enthusiastic over the employment of radium in such conditions, and one cannot but feel that the indiscriminate use of radium, whether or not extended experimental evidence is in favor of its employment in any particular systemic state, will only tend to discredit the therapy, and make conservative medical men cautious about employing it in those diseases which thorough study and extensive clinical demonstration have proved are amenable to its influence.

Fibromas of the Nasopharynx:—A technically benign condition occurring in the nasopharynx, which is, however, often fatal because of its inducing suffocation when it attains a large size, or because it extends to the skull and produces pressure upon the brain. This type of fibroma makes its appearance in adolescence or early adult life. This has long been a source of great perplexity to rhinologists, for surgical excision seems only to encourage the growth, and before the general use of radium came to their assistance there appeared to be no other means of giving these patients any relief whatsoever.

These tumors seem to be peculiar to early life, appearing most commonly at puberty. At the Mayo Clinic the average age in a group of thirty-two patients was nineteen years for males and fifteen for females; in most of these young people the growth had

been in evidence for some little time before the patient came to the Clinic. The growth is fairly rapid up to the twenty-third or fourth year, at which time the patient who has proved able to withstand the mechanical effects of its presence is likely to witness a spontaneous regression. If surgical removal is attempted recurrence is always exceedingly prompt, so that radium offers the only means of cure or palliation which is available, or has ever given permanently satisfactory results.

In the earlier cases treated at the Mayo Clinic, a T-shaped applicator made of lead was used, into which a tube containing 50 mg. of radium element was inserted. This applicator was held in various positions in the nasopharynx, so as to approach the tumor at as many different angles as possible. The original dosage was from ten to fifteen hours, and, although the effect upon the tumor was highly gratifying, the resulting reaction was so great as to restrict seriously the usefulness of the curative agent. In one case the effect upon the surrounding structures was so damaging that the palate was perforated. These violent reactions were later obviated by introducing a lead screen 2 mm. thick and further filtration was provided by the addition of a rubber finger-cot over the whole. Increase of knowledge also enabled the operators to gauge their dosage with greater precision.

It was soon found, however, that steel needles containing radium emanation served the purpose much better in treating these nasopharyngeal fibromata, for their use made it possible to introduce the radiation directly to the deeper parts of the growth. The only drawback to this method was the difficulty in immobilizing the needles, and for this reason emanation seeds eventually supplanted needles as a means of introducing the radiation directly into the tumor tissue. It was usually found necessary to repeat the implantations several times, and considerable trouble was experienced by the "crust-

ing and scabbing"—which was probably the result of necrosis forming about the unscreened tubes—for which oil sprays and the internal use of potassium iodide were recommended.

These nasopharyngeal fibromata can now be handled satisfactorily by the implantation of platinum-screened removable seeds, the use of which is not followed by any reaction or sloughing. The number of these seeds which are required to radiate the entire tumor mass is so much less than that necessary when using the old method that the factor of trauma becomes negligible, and the patient suffers scarcely any inconvenience even while they are in place. A single embedment is all that is required, doing away with all danger of recurrence, as well as the risk and uncertainty attending surgical intervention.

Nasal Polypi.—As Lyons, who was among the first to think of making use of radium in the struggle against the ubiquitous nasal polyp, has aptly pointed out, inasmuch as a nasal polyp is caused by inflammation either of the nasal mucous membrane or that lining the accessory sinuses, any treatment which merely removes the growth, but has no effect upon the underlying cause, will never cure the condition. Some pathologic state of the sinus is likely to be at the bottom of the trouble, and in the majority of cases this will be found to have originated in the anterior and posterior ethmoid sinuses, although there is actually no one of the accessory sinuses which is immune under all conditions.

The most common nasal polyp is a tumor of the myxomatous type, appearing, in the words of the author already quoted, "soft and waterlogged. It may be spherical or pear-shaped with a neck or pedicle which is attached to the mucous membrane over a sinus." It will be found readily movable, but will bleed furiously unless most cautiously approached. For the past six or seven years many attempts to use radium

upon these little neoplasms have been made, and though the reports upon them have been extremely varied, the consensus of opinion seems to be that in conjunction with surgical removal radium is most effectual in preventing or delaying recurrence.

In many cases where the condition had persisted for years, and the patient had undergone operation for removal so many times as to have lost count, the application of radium to the mucous membrane, after snaring off or otherwise extirpating the growths, has prevented the prompt reappearance which had always before seemed inevitable. In Lyons' early cases a 50-milligram tube of radium element was applied for two or three hours at intervals a week apart, the radium treatment being begun two or three days after the growths had been removed. Silver screenage was employed, reinforced by an outer covering of rubber. Sometimes the tube was provided with a ring to which a thread was attached and the tube was then buried directly in the area which had been producing the polypi. In some of the cases as much as a thousand milligram hours was directed to the point of attachment of the polyp.

Gold tubes were used by Sluder, of St. Louis, the thickness of the wall varying from 1.44 mm. to 1.48 mm. These contained 12.5 mg. of radium salts, and were allowed to remain in place for three hours, repeating the application at monthly intervals for three or four times in all. This, he tells us, seemed to check the tendency toward proliferation, and caused existing polyps to shrink. He does not claim to have "cured" any of his patients, but in several most obstinate cases of many years' standing, the tendency toward recurrence seems to have been definitely stopped, and the patients are able to breathe freely and continuously for the first time in years. Laura Lane found that while radium does not cure polypi in every case, "it produces a fibrosis in the myxomatous type, so that

surgical procedures are rendered more effectual."

Radium emanation is better suited for intranasal applications such as are required in dealing with polypi than are the salts of radium, for the passages are usually so reduced in size as to make the employment of anything but the tiniest plaques or tubes out of the question. Properly screened applicators small enough to be applied directly to the proliferating area can be filled with an amount of radium emanation sufficient to prevent recurrence and capable of being administered at a single application, for here, as elsewhere, cumulative dosage is to be avoided, as it is sure to render the tissues radio-resistant, and greatly prolong the duration of convalescence, if, indeed, it does not induce final failure.

Hemangioma of the Septum or elsewhere in the nasal region can be successfully controlled and eradicated by radium applications, the manner of conducting the treatment being similar to that used upon hemangioma located elsewhere. This method was employed at the Radium Clinic of the City Hospital in Boston soon after the opening of that institution, and more recently a number of reports of favorable results in this particular rhinologic lesion have come in from various parts of this country.

Rhinoscleroma.—Another non-malignant rhinologic condition in which radium therapy has proved beneficial is rhinoscleroma. This is a disease apparently indigenous to Poland, whence it has spread into the surrounding territories, and has travelled even as far as Egypt and India. On account of the vast immigration from Central Europe to the United States during the past twenty-five years, the condition is now frequently observed in the clinics of New York and other cities having a large alien population. The specific cause of this lesion appears to be an organism designated *Bacterium rhinoscleromatis*, which closely resembles *B. mucosum capsulatum*,

as this has been isolated in most of the specimens of rhinoscleroma which have been subjected to histological examination.

Of one such examination it was reported that the specimen was composed of a tissue consisting of a loose reticular network of branching fibrils, in which were found very large vacuolated cells containing the typical bacterium. These organisms are short rods, which may or may not be encapsulated. Many plasma cells were also detected, as well as the fuchsin bodies which Russell isolated in cases of carcinoma.

The typical lesion is an extreme induration of the skin and mucous membrane of the nose, with production of granular tissue, which gradually forms hard nodules tending to increase in size, until breathing may be seriously impeded. Operative removal has little deterrent effect, and until the advent of radium, little headway had ever been made in controlling this disease. At the Radium Clinic of the New York Postgraduate Hospital a large number of these cases have been so treated with most satisfactory results. The method first pursued was to make surface applications of screened radium salts, employing a large number of short applications at frequent intervals. When the nares was occluded by proliferation of tissue, this was cut away, and a 25-mg. gold-screened tube inserted in the channel thus made. This method was so much more successful that it eventually led to the abandonment of external applications in favor of embedding needles, which served to distribute the radiation with much greater exactness.

Malignant Lesions:—While malignancy of the nose and its related tissues is relatively uncommon, it is proportionately serious, for most of these neoplasms are of such a high degree of malignancy as to prove rapidly fatal in spite of every effort to stay their progress. Somewhat at variance with clinical experience in other parts of the body, sarcoma in this region has proved

more amenable to treatment than carcinomatous growths, and the effect of radium treatment upon this type of lesion has been most encouraging.

In 1921 Dunbar Roy reported a case of intranasal epithelioma which was first excised, and—when scabbing and bleeding gave evidence that the lesion had not been completely extirpated—treated by three applications of radium at intervals roughly averaging five weeks, the entire dosage amounting to 450 milligram hours. All evidences of the malignant lesion disappeared and after a lapse of nineteen months there was no sign of recurrence, and the patient, a woman of 42 years, was in excellent general condition.

Another case which received treatment about this same time but was not reported for several years, was that of Montgomery and Culver, where the growth was upon the outer surface of the left ala nasi, having been present for something like ten years. At the time the radium treatment was begun the growth had penetrated the nasal cavity, and a plaque was placed on the outside, containing 24.23 mg. of radium element, while a 25 mg. glass tube with a 0.35 mm. silver filter was inserted into the nasal fossa. Both these applicators had outer coverings of 1 mm. lead and 2 mm. rubber in addition to the filtration already mentioned. Three applications were made on consecutive days, totaling eighteen and a quarter hours. The lesion healed perfectly, leaving hardly an appreciable scar, but on illuminating the interior chamber it was seen that at the point where the perforation had occurred the tissue was of a paper-like thinness and perfectly translucent. As the patient was a woman she was, however, peculiarly grateful that so good a cosmetic effect had been obtained, for in some other instances, though healing has been complete, a large defect has remained which proved a most distressing facial disfigurement.

For lesions of the external nose, the im-

plantation of screened seeds which can be removed offers the most approved method of treatment which has as yet been brought forward. Even in comparatively aged subjects the cosmetic effect must be considered, for there are many to whom death itself would be preferable to life with a great degree of facial disfigurement. When the growth is confined to the interior of the nose, suitably shaped applicators of radium emanation will be found satisfactory, easy of employment, and giving a minimum of discomfort and inconvenience to the patient. Hemorrhage is always troublesome in all forms of intranasal lesions, and this the radium application is especially efficient in controlling and abolishing. Even in cases too far advanced to offer any hope of cure, its palliative effects are so great as to warrant its employment in the most desperate conditions.

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TRAUMATIC DISLOCATION OF THE KNEE JOINT: REPORT OF A CASE

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IN order to better understand the occurrence of traumatic dislocation of the knee joint, one must of necessity review its anatomy and normal function. The knee joint is somewhat complicated: there is a joint between each condyle of the femur and the corresponding tuberosity of the tibia, *i.e.*, condyloid joints. Also, one between the patella and the femur, *i.e.*, incomplete arthroidal, since the articular surfaces are

cartilages, the transverse, the coronary, and to these may be added the processes of the synovial membrane.

We shall not make an attempt to digest the intimate structure, the location and position of most of the ligaments, but we cannot conscientiously leave out the discussion of the internal lateral, and the two crucial ligaments—structures which are of considerable importance in the presentation of this paper.

The internal lateral ligament is a broad flat membranous band situated nearer to the back than the front of the joint. It extends from the abductor tubercle of the femur to the inner tuberosity and the inner surface of the shaft of the tibia. It is vertical in its course.

The crucial ligaments (Fig. 1) are two interosseous ligaments of considerable strength situated in the interior of the joint, nearer to its posterior than its anterior part. They are crucial because they cross each other somewhat like the lines of the letter X. The anterior crucial ligament extends from the depression in front of the spine of the tibia (being blended with the anterior extremity of the external semilunar cartilage) and passes obliquely upward, backward, and outward, and is inserted into the inner and back part of the outer condyle of the femur.

The posterior crucial ligament is stronger, but shorter, and less oblique in its direction. It extends from the back part of the depression behind the spine of the tibia and the popliteal notch and to the posterior extremity of the external semilunar cartilage and passes upward, forward, and inward to be inserted into the outer and fore part of the inner condyle of the femur.

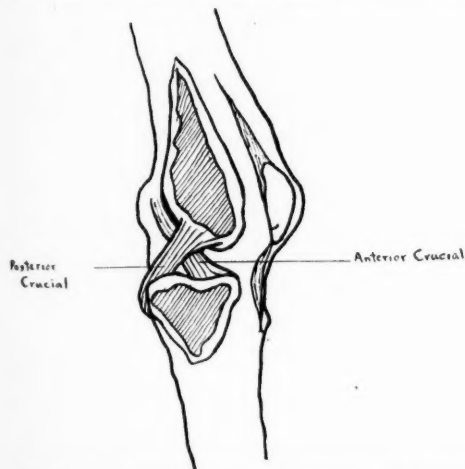


Fig. 1. The crucial ligaments exposed by sawing off the inner surface of the femur and tibia (Davis).

not mutually adapted to each other and, consequently, not gliding. This view, according to Gray (1), is probably due to the existence of the two crucial ligaments, the further detailed function of which will be discussed in the succeeding pages.

As is well known, the knee joint is supported by twelve ligaments: six external and six internal. The six external ligaments are the patellar ligament, posterior, internal lateral, two external lateral, and the capsular. The internal ligaments are the anterior crucial, the posterior crucial, two semilunar

The other structures around the knee joint are the well known muscles of the abductor and the adductor group of the thigh, and the extensor and flexor groups of the knee.

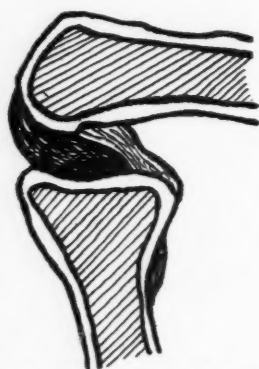


Fig. 2. Posterior crucial ligament seen in sagittal section of the knee joint. Tense in flexion (Groves).

With this brief discussion of the anatomy of the knee joint, we shall proceed to its various motions.

During flexion, the patellar ligament is put upon the stretch, as is also the posterior crucial ligament (Fig. 2) in extreme flexion. The backward direction of the posterior crucial ligament makes it a check upon the posterior displacement of the tibia which occurs during flexion. The other ligaments are all relaxed by flexion of the joint, though the relaxation of the anterior crucial ligament is very trifling. Flexion is checked during life only by the contact of the leg with the thigh.

In the act of extending the leg upon the thigh, the patellar ligament is tightened by the quadriceps extensor; but when the leg is fully extended, as in the erect posture, the ligament becomes relaxed, so as to allow free lateral movement to the patella, which then rests on the front of the lower end of the femur. The forward direction of the anterior crucial ligament makes it a check upon the forward movement of the tibia

upon the femur which takes place during extension. The other ligaments, with the exception of the posterior crucial ligament (Fig. 3), which is relaxed, are on the stretch (Fig. 4). When the limb has been



Fig. 3. Posterior crucial ligament seen in sagittal section of the knee joint. Relaxed in extension (Groves).

brought into a straight line, extension is checked mainly by the tension of all the ligaments except the posterior crucial and the patellar ligaments.

The movement of rotation, which is obtainable when the knee is semi-flexed, is due to a partial relaxation of both crucial ligaments, as well as the lateral ligaments. Inward motion is limited by the tension of the anterior crucial ligament; outward is unchecked by either.

The main function of the crucial ligaments, then, is to act as a direct bond of union between the tibia and the femur, preventing the former bone from being carried too far backward or forward. Thus, the anterior crucial ligament prevents the tibia from being carried too far forward by the extensor tendons, and the posterior crucial checks too great a movement backward by the flexors. They also assist the lateral ligaments in resisting any lateral bending of the joint.

From this brief consideration of the con-

struction of the knee joint it would, at first sight, appear to be one of the least secure of any of the joints in the body. It is formed between the two longest bones, and, therefore, the amount of leverage which

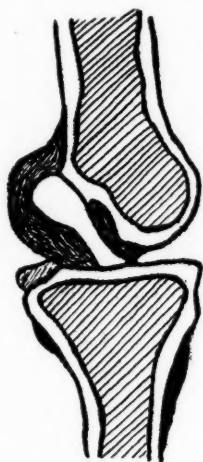


Fig. 4. Anterior crucial ligament seen in sagittal section of the knee joint. Tense in extension (Groves).

can be brought to bear upon it is very considerable; the articulating surfaces are but ill adapted to each other, and the range and the variety of motion which it enjoys is great. All these circumstances tend to render the articulation very insecure; but, nevertheless, on account of the *very powerful* ligaments which bind the bones together, the joint is one of the strongest in the body, and dislocation from traumatism is or should be of very rare occurrence. The greatest power is possessed, undoubtedly, by the crucial ligaments, as is evident from their structure and location, so that it becomes quite evident that a rupture of the crucial ligaments can be caused only by a severe injury of a direct type, unlike the injury of the semilunar cartilages which is caused by an indirect violence of a twisting character.

Consequently, dislocation of the knee would most likely be accompanied by a rup-

ture of the crucial ligaments, as it is inconceivable that these rather short bands of fibrous tissue could remain intact when a sudden severe direct violence causes a complete derangement of the anatomical architecture of the knee, especially in a variety of dislocation found in the authors' case.

It is *a propos* at this time to name the various dislocations of the knee joint, or, to be more specific, dislocations of the tibia upon the femur at the knee joint. The classification usually described is forward, backward, outward, inward, and by rotation. These dislocations are frequently compound and accompanied by injuries to blood vessels.

The forward dislocation of the tibia is the most common of all the varieties, according to the literature; incomplete is predominating; the complete more rare. The usual cause is hyperextension of the knee with direct violence received on the front of the thigh or the back of the leg near the knee. It is well to remember that in hyperextension the anterior crucial ligament is tense and acts as a check on the forward dislocation of the tibia (Fig. 2). When the dislocation is complete, the tibia lies in front of the condyles, and may be displaced upwards a considerable distance. In incomplete dislocation, the articulating surfaces are still in contact.

Backward dislocations, similarly, may be complete or incomplete. They are due to violence received either upon the front of the leg or back of the thigh. The leg is usually in full extension or hyperextension.

Lateral displacements are more infrequent. They are usually of the outward and incomplete variety. The cause of the incomplete outward kind is a forced abduction of the leg, and of the incomplete inward, forced adduction of the leg.

In dislocation by rotation, the leg is rotated about its long axis or axis parallel to it passing through one of the condyles. Such dislocations are of two types: outward

and inward, according to the direction of the toes. In the long axis variety, both condyles are displaced, and in the axis passing through one of the condyles variety,

tremity. At that time, the patient could form an angle of 25° upon flexion.

At the end of the eighth week, under the same management, there was 45° flexion.



Fig. 5 (left). Before reduction, lateral view; (right) before reduction, antero-posterior view.



Fig. 6 (left). After reduction, lateral view; (right) after reduction, antero-posterior view.

the condyle through which the axis passes remains in place.

CASE REPORT

A. G., male, aged 40, was injured February 16, 1926. While lowering a load of pipes into a sewer, a pipe struck his left thigh slightly above the knee joint. He heard a "snapping." The patient was removed to Mt. Sinai Hospital, where an examination revealed that the condyles of the femur could be palpated in the popliteal space. The knee was slightly swollen. A diagnosis of a simple dislocation was made. An X-ray film showed a forward complete dislocation of the tibia (Fig. 5), but no fracture.

Under gas anesthesia, the dislocation was reduced, and a posterior splint applied (Fig. 6).

At the end of the fourth week, the splint was removed and light active massage started.

At the end of the fifth week, patient left his bed, and with the aid of crutches began to put some weight on the injured extremity. More vigorous massage was continued.

At the end of the sixth week, the entire weight of the body was put on the left ex-

At the end of the ninth week, an angle of 60° , and at the end of the tenth week 90° flexion. At the end of the sixth week, the patient had discarded the crutches, and began to use a cane. At the end of the twelfth week, there was 100° flexion, but since then no further improvement. Limp is rather slight. The patient is not working at present, but intends to resume work soon. The knee feels strong, and he has no difficulty in ascending or descending stairs. It is our opinion that further improvement will take place in the future.¹

DISCUSSION

Is the rationale of the above treatment correct? Undoubtedly, there will be some permanent partial disability, but this factor would have been present no matter what the treatment. In view of what we know of the crucial ligaments, and their importance in making the knee one of the strongest joints in the body, would it not have been advisable to open the knee joint and suture the torn anterior crucial tendon (which most likely took place)?

¹This patient has been seen by us since the article was written, and now, at the end of six months, he has an angle of 135° motion, or fully 80 per cent function. He is not complaining of either weakness or pain at the knee joint.

Hey Groves (2), in such and other cases where crucial ligaments are torn, advises an open operation and sutures according to his own modified method. And he is right, for he fully senses the importance of the structure of the knee joint.

Sir Robert Jones (3), although not advocating any particular method, emphasizes long immobilization.

Platt (4) pursues the latter method, citing two cases similar to the authors', and after eleven months obtains 20° flexion, and only after four years, 90° flexion.

But is long immobilization justifiable?

Meadows (5) cites a case of a forward dislocation of the knee in which he reduced the dislocation and applied an elastic bandage. His patient left the hospital on the second day, and returned to work—cured (?)—on the twentieth day.

Which is the method of preference from the viewpoint of the surgeon? Which from that of the patient?

CONCLUSIONS

1. The infrequency, rather than the rarity, of the above condition is considered of sufficient importance to warrant this report.

2. Anatomy and function of the knee joint are briefly discussed.

3. Sufficient emphasis is placed upon the crucial ligaments, which, in the opinion of the authors, are the most important in prevention of dislocation.

4. A report of a case of anterior dislocation of the knee joint is cited.

5. Rationale of the treatment is stated.

6. A further discussion as to the best treatment is invited.

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CASE REPORT

MEDIASTINAL CYST

CASE REPORT

By LEWIS G. BROWN, M.D., COLORADO SPRINGS,
COLORADO

The patient, a married woman, aged 35, had influenzal pneumonia in November, 1918, from which she felt she had never fully recovered. A thyroidectomy in April, 1920, was followed by pneumonia, the patient being confined to bed for seven

terior wall of the shadow was about $1\frac{1}{4}$ inch from the posterior thoracic wall. An outline of the mass was transposed to an anatomical cross-section of the region. The relation of the shadow to the mediastinum, its partial drainage through the bronchus, and its even, globular, non-pulsating outline suggested cyst.

Several attempts at aspiration were made,



Fig. 1. Mass as shown at first examination.

weeks. Since then there has been continuous cough and copious expectoration of thick, foul sputum. Some morning temperature. Marked loss of weight and energy.

X-ray examination, September 7, 1920, showed globular, non-pulsating mass (Fig. 1) $4\frac{1}{2}$ inches in diameter attached to the upper mediastinal shadow and closely related to the left main bronchus, through which it probably drained. It lay behind the bifurcation of the trachea (Fig. 3) and displaced the esophagus $1\frac{1}{2}$ inches to the right and backwards (Fig. 3). The pos-

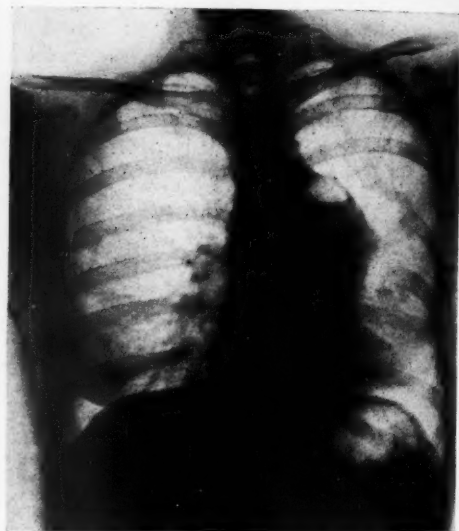


Fig. 2. Mass as shown after injection of air.

but without success. Finally, with the assistance of an improvised arrangement of two fluoroscopes at right angles, a small caliber needle $3\frac{1}{2}$ inches long was inserted safely through the posterior wall. The needle point being found to be well within the mass, aspiration was attempted, but, owing to the thickness of the contents, met with only partial success. A small amount of air was injected which proved by its change of position when the patient assumed various postures that the contents of the mass was fluid or semi-fluid (Fig. 2). The surgeon followed up the needle, still in

place, establishing partial drainage. Following this procedure there was complete cessation of cough and expectoration, and a

practically *nil*, the dressing applied once or twice daily showing only a stain and the odor is scarcely noticeable. An attempt to

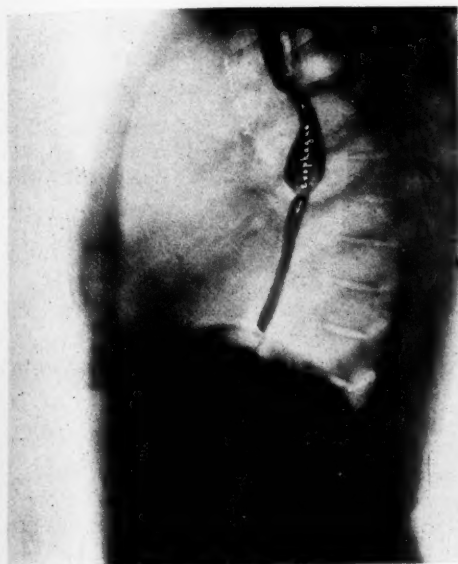


Fig. 3. Showing cyst empty and the relation of esophagus in lateral view. Outline of trachea is well shown on original.

rapid gain in weight and strength followed, with an improvement in general physical condition.

The laboratory test, March 7, 1921, showed saprophytic organisms: no fetal parts.

SUBSEQUENT COURSE

Until October 13, 1925, when the patient was last seen, examinations were made from time to time. The empty cyst as shown in Figures 3 and 4 was readily visible and of only slightly diminished size. The distortion of the esophagus during these five years has remained practically unchanged (Fig. 3).

The patient, who refuses further operation, remains in excellent health and has gained about fifty pounds in weight. There is no cough and no expectoration, but the tube is retained in position. Drainage is



Fig. 4. Cyst empty, with tube in place.

remove the tube about two years ago demonstrated its impracticability at that time by a return of the symptoms.

COMMENT

The relations of the important structures in the proximity of the mass were definitely clarified by the use of an anatomical cross-section chart into which an outline of the shadow was drawn. Data for transposing the shadow outline were taken from routine postero-anterior and transverse films.

The use of the air bubble, purposely introduced after withdrawing a small amount of thick pus, illustrates the possibility of its value in similar cases. This method had been found helpful heretofore, especially in cases of doubtful pleural effusion where aspiration had been unsuccessful. In these cases it may determine the presence of fluid and outline the size and shape of the cavity it occupies. A small artificial pneumo-

thorax may similarly throw important light upon cases of doubtful lung pathology. In the case here reported the information gained was not of material assistance, but it did establish the point of communication with a bronchus, in the following manner. After taking films in various postures, the patient was placed on the left side and an exposure made. This outlined the air at the then high point just to the left of the bifurcation of the trachea. The patient was kept a few minutes in this position, after which a film made with her in the erect posi-

tion showed the absence of an air bubble, indicating its escape.

The use of the fluoroscope was necessary since the surgeon could not, without it, readily recognize when the fine needle point was within the cyst, the fluid in which could be aspirated only with difficulty. In directing the needle with the fluoroscope it was found that the surgeon had a tendency to miss the mass by going to the outer side, quite a natural lack of confidence in the X-ray findings considering the importance of the structures toward the median side.

EDITORIAL

M. J. HUBENY, M.D. } Editor
BENJAMIN H. ORNDOFF, M.D. }
JOHN D. CAMP, M.D. } Associate Editors

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THE SCOPE OF RADIOLOGY

The history of every branch of science is a story of successive discoveries, some accidental, but most of them resulting from much deliberate and laborious experimental effort coupled with logical analysis and synthesis of existing knowledge. This is true of physics, of chemistry, and all the other sciences, but it is also true, at least to a very large extent, of the arts.

The discovery of X-rays by Röntgen has often been cited as an example of an accidental find, but, as in most cases of the kind, this was far from being an accident, at least in the sense in which the word is generally understood. A great deal of antecedent work had been carried out on phosphorescence and allied phenomena incident to the behavior of gases *in vacuo*, and Röntgen himself had long been interested in this phase of physics. Had he not had the knowledge of such work and had he not been so keenly interested in it as to have spent several years delving into some of its secrets, it is not likely that he would have come down to us as the discoverer of X-rays. Indeed, he was so well prepared that when he observed the curious phenomena produced by these unknown rays he realized at once that he was dealing with something new and, instead of contenting himself with idle speculation, proceeded to investigate this new agent with the utmost thoroughness. This is quite obvious to one who reads, even for the first time, his three original com-

munications. But from the discovery of a new agent to its actual scientific application there must ever exist a period of trial and error, and it is through this period that the scope and limitations of such agents are ascertained and established. As far as X-rays are concerned we are still passing through this period. Radium rays, having been discovered so soon after Röntgen's announcement of the X-rays, are placed in the same period as far as our general knowledge of them is concerned.

For ages, thinking men the world over were familiar with some of the therapeutic effects produced by sunlight. Even in the days of the Egyptians and later of the Greeks, sunlight was actively made use of and recommended for certain diseases. But until twenty years ago we did not understand how sunlight accomplished some of its miracles. Even such men as Rollier, who was working with it on a large scale and whose results astonished the medical profession, were then unable to specify the mechanism by which such remarkable effects were brought about. As the result of the discovery of radiant energy and the concentration of scientific thought and experiment in this direction we have gradually come to learn at least the chief element in the action of the sun on living tissues.

Therefore, radiology, if it means anything, means that science which deals with radiant energy. This necessarily involves, not only X-rays, radium rays, and ultraviolet rays, but the entire range of the spectrum. The fact that certain portions of the spectrum are little known and their possible value in the treatment of disease still a matter of conjecture has nothing to do with the signification of the word "radiology." Like all the other sciences the scope of radiology

will undoubtedly expand as more knowledge accumulates. The title of "radiologist," therefore, applies to any person qualified in radiology, but more specifically to the physician who employs radiant energy in the diagnosis or treatment of disease. Those who employ only roentgen rays are known as "roentgenologists."

In this connection a somewhat anomalous situation has developed. Within a very short time following the discovery of the medical importance of X-rays, many physicians became interested in this new field. In some cases this interest was short-lived, but certain members of the profession gradually came to devote to it their entire time; in other words, a new medical specialty came into being. Then radium appeared. The logical thing would have been for those physicians who were specializing in the medical application of roentgen rays to assimilate this new agency and to broaden their activities accordingly. Radium rays constituted merely another portion of the spectrum. In many instances this course was wisely followed, but, for various reasons, certain roentgenologists continued to limit their interest to roentgen rays; indeed, many confined their roentgenologic activities to the diagnostic application of roentgen rays and paid no attention whatever to roentgenotherapy. Perhaps an important factor in the development of this situation was that the discovery of radium so soon after that of roentgen rays did not allow sufficient time for those readjustments which are a necessary accompaniment of such a set of circumstances. Moreover, the cost of radium was prohibitive to all but the well-to-do. Hence it was that many physicians interested in roentgen rays found themselves unable to acquire radium, while others who were not at all concerned with the use of X-rays, but possessed the means, purchased radium and proceeded to employ it for treatment. Among the latter were some who had

little or no knowledge of the fundamental principles governing the action of radiant energy, and, since ignorance is never conducive to a high grade of work, many possessors of radium gradually disposed of it, and more would have done so had not the sudden sharp drop in the market value of radium (which followed upon the discovery of the rich deposits of radium ore in the Belgian Congo) prevented them from doing so without great loss.

While this was going on, the practice of medicine itself was undergoing important changes. The intense industrial and commercial development of the country made possible by our tremendous natural resources and an unprecedented influx of immigrants led to a wholly disproportionate gathering of people in the cities. An era of intense commercial expansion and competition was thus inaugurated. An exaggerated extension of the credit system to retail trade was the next step and this was accompanied by an unparalleled use of advertising, the aim of which was to increase the volume of sales to the utmost degree.

Such intense commercialization was bound to exert a widespread influence on the life of all American citizens. We see its effects on every hand. Even the professions have not escaped the contagion. Physicians may be heard to ask one another, "How much business did you do last year?" or "How is business?" The old and time-honored ethical standards are going through a process of strain if not disintegration; at least they are being slowly altered, and many thoughtful members of the profession feel that present-day tendencies are not toward improvement.

Now, as a result of these economic changes and the sociologic adaptations which they entail, we find manufacturers of chemicals, of pharmaceutical preparations, of medical instruments and apparatus, exerting an undue influence on physicians by the va-

rious methods of twentieth century commerce. Physicians are hounded by high-pressure salesmen, and induced to purchase articles about which, as often as not, they know nothing. These include such instruments as ophthalmoscopes, microscopes, roentgen-ray machines, diathermy machines, and ultra-violet lamps. All these instruments and apparatus are indispensable to him who is prepared to make intelligent use of them, but only a small percentage of physicians have been so prepared. The obvious consequence is that the country is flooded with what has been aptly termed "general specialists," physicians who, although ill-qualified or wholly unqualified, attempt to do that which is or should be the exclusive province of specialists. The manufacturers and their traveling mouthpieces assure them that it is folly for them to send patients to the specialist for a roentgen-ray examination or for roentgen-ray or radium treatment; that they should purchase equipment of their own and that, after a little simple instruction, provided free of cost by the manufacturer, they will be able to make such examinations and to give such treatment themselves; not to mention the increased-prestige and greater-income arguments. The natural result is a vast amount of incompetent work. And who suffers? Not only the trusting public, but the medical profession as a whole; and no one can say that such discredit is not deserved as long as no serious effort is made to correct such a situation.

This may appear an unwarranted digression, but not entirely so, because many physicians who claim to be specialists are hardly justified. They have not completely mastered the elements of their specialty. And we radiologists are no exception. In a certain measure the blame devolves equally upon ourselves, because, instead of keeping abreast in every department of radiology and preparing ourselves to render to our

fellow-physicians and to our patients that service which they have a right to expect of us, many have preferred, for various motives, to limit their interest to one phase or another of the subject. If radiology is to continue as an individual specialty, physicians working in the various parts of this increasingly broad field must familiarize themselves thoroughly with every feature of it and keep themselves constantly prepared to turn their activities from one end of the field to the other as the requirement of a given medical problem in diagnosis or treatment may demand. If this course is not recognized and religiously followed, radiology will be gradually swallowed up and disappear as such, and its short-sighted disciples will deserve their fate.

A. U. DESJARDINS, M.D.

THE STANDARDIZATION COMMITTEE

Steps leading to the ultimate adoption of a standard unit of measure of X-ray dosage are being considered by the Committee and departmental officials. These are matters that cannot be rushed through, as there are many aspects of the problem to be weighed, scientific and legislative, before a standard can be adopted that shall be at once accurate, fair, and practicable. The Committee is moving as progressively in the matter as the nature of the negotiations warrants.

INTERNATIONAL RADIOTHERAPIE is a new work under the guidance of Dr. J. Wetterer, the first issue of which was ready for distribution in September. It contains meritorious and original work accomplished during the year throughout the world, in the fields of Roentgen-, Curie-, Light-, and Electro-therapy.

PRELIMINARY PROGRAM OF TWELFTH ANNUAL MEETING

MILWAUKEE, NOV. 29-DEC. 4, 1926

Since the publication of the outline of the program of the Twelfth Annual Meeting, in RADIOLOGY for September, numerous additions and changes have been made, so that it seems desirable to present it in a more nearly complete form, as was announced would be done. Even this may not be said to be the program's final form, however; for that, members are referred to the separate programs which will be issued shortly before the day of convening. In its present form, however, it will be found to be rich in promise of interest and profit to all who attend.

MONDAY, NOVEMBER 29

Afternoon Session, 1:30 P. M.

1. ROBERT S. LANDAUER, Ph.D., Chicago, Ill.

"The Use of Dental Films in the Determination of Stray X-radiation"

Abstract:—Dental films were exposed to accurately measured fractions of erythema doses of X-ray, and developed under standard reproducible conditions. Film reproductions, accompanied by a table, make a quantitative estimation of fraction of erythema doses of scattered and secondary X-rays by means of dental films, a procedure which might easily be carried out in any roentgen laboratory.

2. ALBERT BACHEM, Ph.D., Chicago, Ill.

"Physiological and Biological Observations of Skin Reactions"

Abstract:—(1) Erythema doses are not yet determined with sufficient accuracy, physically and biologically, as to permit of their being used for comparison. Measurements by the author and others indicate that the physical dosage supposed to produce an erythema varies up to about 400 per cent.

(2) A communication with most of the radiologists in this country revealed the fact that, based upon treatment conditions (ma., K.V., F.S.D., filter, etc.), the dosage varies in a still wider range. This communication also indicated that it is not yet established how rays of different hardness compare as to their effects on the skin.

(3) By his own experiments, conducted on twenty-three students, the comparison of rays of varying hardness was made for three qualities of rays. The variation of the sensitivity of the skin was tested by exposure of fifteen students to unfiltered rays. By this test an average sensitivity was determined which varied slightly, except one case of idiosyncrasy.

(4) By quantitative measurements of the erythema and the pigmentation it can be stated that the course of the reaction varies greatly, and that it is difficult to establish a general rule.

3. E. A. POHLE, M.D., Ann Arbor, Mich.

"Studies of Capillary Changes as a Result of Roentgen-ray Erythema Occurring in the Human Skin"

Abstract:—In continuation of a paper presenting the results of a study of the skin capillary changes after exposure to unfiltered roentgen rays, which was read before the last Annual Meeting, this essay deals with identical observations made by using filtered radiation of short wave length. In an appendix, the effect of ultra-violet rays on the blood vessels of the skin will be related.

Discussion opened by A. U. DESJARDINS, M.D., Rochester, Minn.

4. W. W. BELDEN, M.D., and JOHN REMER, M.D., New York, N. Y.

"Diagnosis and Therapy of Intrathoracic Tumors"

Abstract:—Discussion of intrathoracic tumors must be approached from a number of different aspects. First, the diagnostic problem presents itself for our consideration, and, secondly, what course of therapy is best suited to the individual case.

We must divide these tumors into two distinct groups, the first being benign tumors, which are relatively quite rare, and secondly, the largest and most frequent, malignant neoplasms. The malignant neoplasms must be further subdivided into a histological classification of carcinoma and sarcoma. In addition, they must be considered and may be classified as to their anatomical location in the thorax, namely, pleural, bronchial, parenchymal or mediastinal. We must consider them further as to whether they are primary or secondary (metastatic). The largest percentage of primary malignant growths in the lung are carcinomata.

Discussion on paper of DR. BELDEN and

DR. REMER opened by G. W. GRIER, M.D., Pittsburgh, Pa.

Symposium on the Use of Lipiodol

Leader: H. A. JARRE, M.D.,
Detroit, Mich.

5. STUART PRITCHARD, M.D., BRUCE
WHYTE, M.D., and J. K. M. GOR-
DON, M.D., Battle Creek, Michigan.

*"The Use of Supra-glottic, Intra-
tracheal Injections of Iodized Oil in
the Diagnosis of Bronchiectasis"*
(Clinical Demonstration)

Abstract:—Bronchiectasis occurs more often than it is diagnosed. It exists in various degrees of severity, from the advanced form with frank symptoms and physical signs to the early cases with doubtful symptoms and the absence of physical signs. In the latter form there may be a bronchial dilatation situated in the lung root only. The endobronchial injection of iodized oil frequently permits the diagnosis of these early and doubtful cases. This procedure should be among the diagnostic resources of the roentgenologist. It demands a technic that is simple for the patient and for the operator. The supra-glottic method meets these requirements. The apparatus needed is simple and its usage may be readily self-taught by any physician. Since 90 per cent of all dilations occur at or below the level of the lung roots, this procedure is of greatest diagnostic value.

6. ADOLPH HARTUNG, M.D., Chicago,
Illinois.

*"The Diagnostic Value of Iodized Oil
in Intra-thoracic Lesions"*

Abstract to be submitted later.

7. IRVING F. STEIN, M.D., and ROBERT
A. ARENS, M.D., Chicago, Ill.

*"Lipiodol and Pneumoperitoneum in
Relation to Gynecology"*

8. A. W. PROETZ, M.D., and EDWIN C.
ERNST, M.D., St. Louis, Mo.

*"The Displacement Method of Sinus
Diagnosis with Iodized Oils"*

Abstract:—A short time ago one of us published the description of a new method for introducing fluids into the nasal sinuses without traumatizing their walls. The name "displacement irrigation" was given to the method. It consists, briefly, in floating the solution into the nose with the head in such a po-

sition that the ostium of the sinus will be inundated. The air is then partially and very gently exhausted from the sinus by means of a suction apparatus and on releasing the vacuum the fluid enters the sinus.

The method was originally devised for treatment, but the employment of iodized oils opens a field for accurate X-ray diagnosis. This paper describes the positions employed to fill the desired cells and discusses the technic in general; the accompanying slides demonstrate the oil in position in the sinus.

Discussion.

Executive Session 5 p. m., followed by Dinner, Counselors' Meeting and Executive Session.

TUESDAY, NOVEMBER 30

Morning Session, 8 A. M.

9. OTTO GLASSER, Ph.D., and WILLIAM
H. MEYER, M.D., New York, N. Y.

*"Further Studies on the Influence of
Radiation Quality on the Measured
Intensity of the Erythema Dose"*

Abstract:—Experiments, correlating the number of roentgen units measured by ionization in air as compared with the reaction of the human skin, employing different radiation qualities, have been extended to softer rays than previously reported. Again, it has been shown that the roentgen-ray quantities (measured in R-units) which produce similar biological reactions on the skin, decrease markedly with decreasing penetration of the rays. It has been found, however, that there exists a minimum in this number of R-units per erythema which is to be found near a radiation quality corresponding to a half value layer of about 2 mm. of aluminum. For still softer rays the number of R-units necessary to produce the same skin reaction again increases.

Furthermore it can be shown that for most of the radiation qualities used in roentgen therapy the number of R-units per erythema divided by the half value layer in water is a constant; the value of this quotient is 220 for the R-units as used at present in our laboratory.

A new comparison of the R-unit used in Germany and the R-unit used in our laboratory has been made by means of calibrated instruments.

Discussion opened by A. W. ERSKINE, M.D., Cedar Rapids, Iowa.

10. A. U. DESJARDINS, M.D., Roches-
ter, Minn.

"Analgesic Properties of Roentgen Rays"

Abstract to be submitted later.

Discussion opened by R. H. STEVENS, M.D., Detroit, Mich.

11. HENRY SCHMITZ, M.D., Chicago, Illinois.

"A Study in Radiation Sensitiveness of the Different Cell Types of Cervical Carcinoma"

Abstract to be submitted later.

12. J. T. STEVENS, M.D., Montclair, N. J.

"Treatment of Carcinoma of the Cervix with Radium, Roentgen Ray and Electrocoagulation"

Abstract to be submitted later.

13. H. H. BOWING, M.D., Rochester, Minn.

"The Treatment of Carcinoma of the Rectum by Irradiation; A Report of a Small Series of Cases"

Discussion.

Symposium on Intra-oral Cancer

Leader: DOUGLAS QUICK, M.D., New York City

14. E. STARR JUDD, M.D., Rochester, Minn.

"Surgery in Intra-oral Cancer"

15. CURTIS F. BURNAM, M.D., Baltimore, Md.

"Radium in Intra-oral Cancer"

16. CROSBY GREEN, M.D., Boston, Mass.

"Electrocoagulation in Intra-oral Cancer"

17. JAMES J. DUFFY, M.D., New York, N. Y.

"Treatment of Cervical Nodes in Intra-oral Cancer"

Discussion.

18. U. V. PORTMANN, M.D., Cleveland, Ohio.

"Problems in Physiotherapy"

Discussion.

TUESDAY, NOVEMBER 30

Afternoon Session, 1:30 P. M.

19. W. T. BOVIE, Ph.D., Cambridge, Mass.

"Some of the Fundamental Principles of Radiation Therapy"

20. R. H. STEVENS, M.D., Detroit, Mich.

"Methods of Radiation Therapy in Dermatology"

Abstract to be submitted later.

21. H. P. DOUB, M.D., Detroit, Mich.

"Radiation Effects in Nephritis"

Abstract to be submitted later.

Discussion.

Symposium on the Urinary Tract

Leader: B. H. NICHOLS, M.D., Cleveland, Ohio

22. D. N. EISENDRATH, M.D., and ROBERT A. ARENS, M.D., Chicago, Ill.

"Further Studies of the Normal Renal Pelvis"

23. WALTER M. KEARNS, M.D., Milwaukee, Wis.

"Pyelography in Renal Tuberculosis"

Abstract:—Review of opinions relating to the use of pyelography as an aid in the diagnosis of renal tuberculosis. Results of a study of injected postmortem tuberculous kidney specimens. Demonstration of the findings. Discussion of the reliability of the pyelogram, its value as compared to other diagnostic methods, and its dangers. Lantern slides.

24. EDWARD W. KORNIG, M.D., Buffalo, N. Y.

"X-ray Assistance in Solving Genito-urinary Problems"

Abstract to be submitted later.

25. VINCENT J. O'CONOR, M.D., and ARTHUR REMMERT, M.D., Chicago, Illinois.

"The Value of Ureteropyelography as a Diagnostic Aid." (Based on an analysis of the findings in 450 consecutive, unselected cases.)

Discussion opened by JAMES P. SARGENT, M.D., Milwaukee, Wis.

Executive Session, 5 P. M.

Election of Officers

TUESDAY, NOVEMBER 30

Evening Session, 8 P. M.

26. M. J. SITTFIELD, M.D., New York, N. Y.

"The Causation of Cancer with Reference to Recent Experimentation"

Abstract to be submitted later.

27. MISS MAUD SLYE, Chicago, Ill.

"Observations on the Nature of Cancer"

Abstract to be submitted later.

Discussion opened by R. H. STEVENS, M.D., Detroit, Mich.

28. ALBERT SOILAND, M.D., Los Angeles, Calif.

"The Metallic Colloids in the Treatment of Cancer." (A preliminary report.)

Abstract:—This is a brief review of the work in this clinic with the various metallic colloids, which have been advocated from time to time as of service in the treatment of cancer. This study has been taken up in connection with radiation therapy and includes also our limited clinical experience with colloidal lead along the lines laid down by Blair Bell.

29. H. J. ULLMANN, M.D., Santa Barbara, Calif.

"The Use of Colloidal Lead in Cancer after the Method of Blair Bell." (Preliminary report.)

Abstract to be submitted later.

Discussion on papers of DR. SOILAND and DR. ULLMANN opened by DOUGLAS QUICK, M.D., New York, N. Y.; BURTON J. LEE, M.D., New York, N. Y.

30. HERMANN WINTZ, M.D., Erlangen, Germany.

"The Action of Roentgen Rays on Glands of Internal Secretion"

Abstract to be submitted later.

Discussion.

31. EDWIN C. ERNST, M.D., St. Louis, Mo.

"Fluoroscopic Unit"

32. WALTER C. ALVAREZ, M.D., Rochester, Minn.

"Motion Picture of Intestinal Peristalsis in Animals"

Discussion opened by LEWIS GREGORY COLE, M.D., New York, N. Y.; JAMES T. CASE, M.D., Battle Creek, Mich.

33. PROF. B. NIEKAU, TUEBINGEN, Germany.

"Human Skin Capillaries and Their Changes during Circulation of the Blood." (Presented by Dr. E. A. POHLE, Ann Arbor, Mich.)

Discussion.

WEDNESDAY, DECEMBER 1

Morning Session, 8 A. M.

35. J. A. E. EYSTER, M.D., Madison, Wis.

"Practical Aspects of Radiography of the Heart"

Abstract:—Efforts to estimate the size of the human heart from mensuration of the frontal X-ray silhouette and to establish normal standards have been made by several workers. The purpose of the present investigation is to prove the normal standards by statistical consideration of the data from carefully selected normals, and to examine the results from the standpoint of frequency of departure from the normal standard in series of normal hearts and in those presenting clinical evidence of cardiac disease. It is only when this is done that the usefulness of the method can be established as an aid in cardiac diagnosis. The data presented prove that the presence of cardiac hypertrophy can be determined with an accuracy which establishes the method as a useful one and comparable in its value to other useful methods of medical diagnosis.

36. CHARLES E. IDE, M.D., Milwaukee, Wis.

"Correlation of X-ray Plates, Clinical Findings, and Blood Pressure Readings in a Series of 300 Cases"

Abstract:—Data will be used from over two thousand physical examinations made during the past year under supervision of Dr. Ernest W. Miller, Medical Director of the Employees Mutual Benefit Association. The members of

this association may have such health examinations annually, if they desire. Its purpose is to discover, if possible, leads which point to disease tendency. In each case a general physical examination was made, and, when necessary, X-ray and laboratory work added to corroborate the physical findings. The blood pressure readings from both arms were recorded in every case. In over three thousand instances X-rays of the chest have been taken. Special study has been made of these, together with blood pressure and physical findings. From data thus obtained correlation of the three procedures will be attempted and slides used in illustration.

Discussion opened by ERNEST W. MILLER, M.D., Milwaukee, Wis.

37. A. W. CRANE, M.D., Kalamazoo, Mich.

"Dilatation of the Thoracic Aorta"

Abstract to be submitted later.

38. B. H. NICHOLS, M.D., Cleveland, Ohio.

"Some Observations from a Roentgenological Study of the Aorta"

Abstract to be submitted later.

39. W. H. WALLACE, M.D., Brooklyn, N. Y.

"Early Infections in the Thorax"

Abstract:—The object of this paper is to prove that infections in the thorax, especially of the lungs, are as a general rule through the lymphatics. Too frequently we are biased in our interpretation by the clinician and the clinical findings. To use a "Dooleyism," we should be able to interpret shadows before they are there. By that I mean light shadows that escape reproduction on a slide and can be seen only on a negative of the proper density, stereoscoped vertically. Lymphatic infiltration in tuberculosis always precedes bronchial infiltration and nearly always can be detected in a good diagnostic plate. The salvation of many of these cases depends on early diagnosis and we should be careful to get good plates and insist on our interpretation to the clinician if such shadows are found.

40. H. K. DUNHAM, M.D., Cincinnati, Ohio.

"The Value of an X-ray Study in the Care of Cases Suffering from Pulmonary Tuberculosis"

Abstract:—The paper will be illustrated by one hundred cases displayed in the Scientific

Exhibit. The paper will deal with: (1) doubtful cases in childhood and how they must be handled; (2) early adult cases, and how they must be carefully supervised by repeated X-ray study; (3) old fibroid cases, and how they may be controlled by physical and clinical symptoms; (4) cavities, and what may be done to prevent them infecting other parts of the lung; (5) tuberculous pneumonia, and what may be done to prevent the spread of the disease and extension of cavitation; (6) a plea for more general use of X-ray study of lung pathology in the care of cases suffering from pulmonary tuberculosis.

41. R. B. BETTMAN, M.D., and ROBERT A. ARENS, M.D., Chicago, Illinois.

"Empyema"

42. L. R. SANTE, M.D., St. Louis, Mo.

"Atelectasis, or Massive Collapse of the Lung"

Abstract:—Massive (atelectatic) collapse of the lung is a definite clinical entity, characterized by atelectatic collapse of the previously well aerated lung without evidence of bronchial obstruction or intrathoracic disease which could account for it. The condition is not associated with pneumothorax and its exact mechanism has never been explained. The X-ray picture is characteristic. Two cases having unusual features are reported in detail, one with autopsy findings.

43. ISAAC GERBER, M.D., Providence, R. I.

"Further Observation of the X-ray Treatment of Bronchial Asthma and Allied Conditions"

Abstract to be submitted later.

44. F. W. O'BRIEN, M.D., Boston, Mass.

"Elevation of the Diaphragm"

Abstract to be submitted later.

Discussion opened by W. W. WASSON, M.D., Denver, Colo.

WEDNESDAY, DECEMBER 1

Afternoon Session, 1:30 P. M.

45. J. PAUL KEITH, M.D., D. Y. KEITH, M.D., and J. C. BELL, M.D., Louisville, Ky.

"The Significance of Delay of Barium in the Second Portion of the Duodenum"

Abstract to be submitted later.

Symposium on Chronic Stasis in the Upper Intestinal Tract

Leader: J. F. HERRICK, M.D., Ottumwa, Iowa

46. W. H. HOLMES, M.D., Chicago, Ill.
"Chronic Duodenal Obstruction"

Abstract:—Acute form may be a dreaded complication after operation. The chronic is seldom suspected. Cause may be within the viscus, usually the result of disease in adjacent viscera. Mesenteric pressure probable cause. Incidence unknown. Is unrecognized or ignored by many. Symptoms are those of chronic dyspepsia, chronic constipation, neuromuscular weakness and instability. Treatment medical or surgical, depending on the type.

47. E. L. KELLOGG, M.D., New York, N. Y.

"Chronic Duodenal Stasis"

Abstract:—The literature dealing with this condition will be reviewed and the etiologic factors discussed, such as visceroptosis, especially of the right half of the colon, the effect of peritoneal bands, either congenital or acquired, tumors and inflammatory conditions, abnormalities of shape and position of the duodenum and arterial compression from the superior mesenteric, mid-colic or ileo-colic arteries, the causes varying greatly but possessing a common attribute in their interference with duodenal mobility, leading to the production of mechanical and toxic symptoms. The symptoms will be described. They vary, depending on the cause and stage of the condition, characterized by epigastric pain or discomfort, nausea, vomiting of food or bile, headaches, mental or physical depression, and loss of weight. The various physical signs and X-ray findings in this condition will be mentioned and the indicated medical and surgical treatment, with special reference to the indication for duodeno-jejunostomy.

Slides of X-ray films and drawings will be shown to illustrate the problem. Case reports and analyses of results of operative procedures will be presented.

48. J. A. WOLFER, M.D., Chicago, Ill.
"Chronic Duodenal Obstruction should be Recognized and its Cause, if Possible, Determined, before an Operation is Attempted"

Abstract:—Cases can be grouped into two types: (1) The dehydrated toxic cases; (2) those cases in good general condition. In the

first type, the treatment should be directed toward fluid and nutritional replacement before any operation is undertaken. In the second type, the cause of the obstruction should be removed. If this is possible then duodeno-jejunostomy is the operation of choice.

49. JAMES T. CASE, M.D., Battle Creek, Mich.

"Chronic Stasis—Upper Intestinal Tract"

Abstract:—Classification of causes of stasis: primary malignant disease, secondary malignant disease, arterio-mesenteric obstruction, obstruction secondary to ulceration of the stomach or upper small bowel, diverticula, diverticulosis and diverticulitis, para-duodenal hernia, hernia into the lesser peritoneal cavity. Special technic of examination. Interpretation of findings. Consideration of sources of error in interpretation.

50. A. C. IVY, M.D., Chicago, Ill.

"Normal and Abnormal Motor, Secretory and Absorptive Phenomena of the Upper Alimentary Canal"

Abstract:—Critically discussing the literature, outlining problems for investigation and making application wherever possible.

Discussion.

Symposium on Colonic Conditions

Leader: L. J. CARTER, M.D., Brandon, Manitoba, Canada

51. L. J. CARTER, M.D., Brandon, Manitoba.

"Colonic Dynamics"

52. J. C. McMILLAN, M.D., Winnipeg, Canada.

"Colonic Spasticity"

53. C. M. HENRY, M.D., Regina, Sask.

"Colonic Stasis"

54. B. R. MOONEY, M.D., Edmonton, Alberta.

"Colonic Ulceration"

55. W. B. MCGUFFIN, M.D., Calgary, Alberta.

"Colonic Malignancy"

56. J. A. EVANS, M.D., LaCrosse, Wis.

"Carcinoma of the Splenic Flexure"

Abstract:—Review of literature, with sta-

tistics; case report; X-ray diagnosis, including differential diagnosis; treatment.

Discussion opened by J. L. YATES, M.D., Milwaukee, Wis.

WEDNESDAY, DECEMBER 1

Evening Session, 8 P. M.

WISCONSIN DAY PROGRAM

(Semi-public)

Symposium on Cancer

Leader: JOSEPH SMITH, M.D., President

Wisconsin State Medical Society

FATHER FOX, Milwaukee, Wis.

Opening Remarks

57. J. M. MARTIN, M.D., Dallas, Texas.

"X-ray Treatment of Skin Malignancies"

Abstract:—While the object of this paper is to discuss the value of X-rays in the treatment of skin cancer, a tribute is paid to all other methods that will actually cure the disease. No one method or combination of methods is infallible in the treatment of advanced cases of cancer. The advantages of X-ray methods in the treatment and cure of skin cancer are stressed under seven headings, as follows: (1) the value of X-ray treatment as compared with other methods of treatment; (2) the possible mortality hazards in using X-ray in the treatment of skin cancer; (3) the degree of discomfort resulting from X-ray treatment; (4) the length of time usually required to effect a cure; (5) the cosmetic after-effects of X-ray treatment; (6) the extent to which metastases may be controlled by X-ray treatment; (7) the possibility of recurrence following X-ray treatment of skin cancer.

The multiple dose method is advocated and the number of doses used is four, six, eight or more. The length of the dose is based on the method of factor determination.

Motion Picture Film

J. M. MARTIN, M.D., Dallas, Texas.

"The Cancer Problem"

Abstract:—The motion picture contains about 1,250 feet of film. It is complete with titles and subtitles and illustrates almost every type of skin cancer.

58. GEORGE E. PFAHLER, M.D., Philadelphia, Pa.

"X-ray and Radium Treatment of Malignancy"

Abstract to be submitted later.

59. WILLIAM J. MAYO, M.D., Rochester, Minn.

"The Surgical Treatment of Cancer"

Abstract:—The surgical treatment of cancer includes not only the excision with the knife, but all other methods which have for their immediate or ultimate object removal of the cancerous process. Radiotherapy, the actual cautery, and surgical diathermy are all well recognized adjuncts to surgery; each has a field of usefulness.

Excision with the knife has the advantage over other methods in that it removes not only the diseased tissue, but also the lymphatic tissues through which metastasis occurs.

For cancers in certain situations which are readily accessible, especially epitheliomas about the face where scarring is undesirable, radiotherapy and surgical diathermy are useful. In a number of cases of cancer of the cervix uteri, radium is superior to the knife. X-ray has a field of usefulness both as a curative and as a palliative agent. The value of X-ray as a routine before and after operation is still under discussion.

In inflammatory types of cancer, the actual cautery or the electrocautery knife, or the use of grades of heat which will affect the cancer cell without injury to the normal cell, are of great value.

In the treatment of special varieties of cancer in situations that cannot be exposed effectively for operation without considerable risk and future disability, for instance, tumors of the mucous membranes of the mouth and of the bladder, and small localized malignant growths in the rectum, surgical diathermy is of great value.

The possibilities of the surgical cure of cancer by these various means depends not only on the stage of the disease but also on the structure of the cancer cell, as shown by the work of Wilson and MacCarty, and of Broders in his index of malignancy.

The proper treatment of cancer depends on the combined efforts of the surgeon, the radiologist and the pathologist in evolving methods of treatment, which should be adapted to each patient, rather than that all patients should be adapted to the one method of treatment.

THURSDAY, DECEMBER 2

Morning Session, 8 A. M.

60. STANLEY J. SEEGER, M.D., Milwaukee, Wis.

"Pancreatic Lithiasis"

Discussion opened by A. C. IVY, M.D., Chicago, Ill.

61. MONTROSE T. BURROWS, M.D., LOUIS H. JORSTAD, M.D., and EDWIN C. ERNST, M.D., St. Louis, Mo.

"Vitamins in Carcinoma and Effects of X-ray Radiation"

Abstract to be submitted later.

Discussion on paper of DR. BURROWS, DR. JORSTAD and DR. ERNST opened by WALTER C. ALVAREZ, M.D., Rochester, Minn.; JAMES T. CASE, M.D., Battle Creek, Mich.; LEWIS GREGORY COLE, M.D., New York, N. Y.

Symposium on the Roentgenological Aspect of the Diagnosis of Diseases of Infants and Children

Leader: LEON T. LEWALD, M.D., New York City

62. MAX M. PEET, M.D., Ann Arbor, Mich.

"Diagnosis of Cerebellar Lesions"

63. G. J. NOBACK, M.A., Ph.D., New York, N. Y.

"Further Studies of the Infant Thorax, with Special Reference to the Thymus and Heart"

64. W. W. WASSON, M.D., Denver, Colorado.

"The Chest"

Abstract:—Special reference is made to the diagnosis of pulmonary tuberculosis; diagnosis and treatment of enlarged thymus gland; enlarged bronchial lymph nodes; foreign bodies in the air passages, and congenital and acquired lesions of the heart.

65. E. L. JENKINSON, M.D., and PHILLIP LEWIS, M.D., Chicago, Ill.

"The Osseous System"

Abstract:—Special reference is made to the diagnosis of rickets, scurvy, lues, Still's disease, osteomyelitis, coccidioidal granuloma, osteogenesis imperfecta, cretinism, achondroplasia, marble bone, and epiphysitis.

66. WILLIAM A. EVANS, M.D., Detroit, Mich.

"Sinuses and Mastoid"

Abstract:—Special reference is made to the technic in the roentgen examination of children.

67. HENRY G. BUGBEE, M.D., New York, N. Y.

"Urinary Tract"

Abstract:—Special reference is made to the diagnosis of congenital and acquired lesions in infants and children.

68. LEON T. LEWALD, M.D., New York, N. Y.

"The Digestive Tract"

Abstract:—Special reference is made to the diagnosis of congenital hypertrophic stenosis, cyclic vomiting, anatomical variations and pathological changes in the colon, and foreign bodies.

69. W. V. MULLIN, M.D., Cleveland, Ohio.

"An Experimental and Clinical Study Showing the Role of the Accessory Nasal Sinuses in the Production of Bronchial Disease"

Abstract:—It is now a definitely recognized clinical fact that disease of the paranasal sinuses is an etiological factor in producing bronchial infection.

Experiments on rabbits and cats showing lymph drainage of the nasal accessory sinuses.

Sinus disease producing secondary infection in the chest is usually of the hyperplastic type, starting in infancy or early childhood. Is of low grade virulency. Produces secondary enlargement of the peribronchial and mediastinal glands. Much of the responsibility in the diagnosis of both the sinus disease and the bronchial disease must rest with the roentgenologist.

Discussion.

THURSDAY, DECEMBER 2

Afternoon Session, 1:30 P. M.

70. EDWARD H. SKINNER, M.D., Kansas City, Mo.

"Chronological Changes of the Human Vertebral Column; Their X-ray Analysis"

Abstract:—An attempt to show that certain X-ray findings in the human spine sometimes reported as hypertrophic arthritis, infectious arthritis, Kummel's disease, atrophic arthritis, etc., are frequently merely the ex-

pression of chronologic changes in the human spine. Gross deformities of the human spine are found without a single clinical symptom. An attempt will be made to evaluate the roentgen findings where injury has brought the patient in for a roentgen examination.

Symposium on Medical Education with Reference to Roentgenology

Leader: PRESTON M. HICKEY, M.D.,
Ann Arbor, Mich.

71. GEORGE A. LINDSAY, Ann Arbor, Mich.

"Studies in the Physics of X-rays for Students in Medicine"

Abstract:—A study of the underlying principles and theories of a subject is of value also to those concerned mainly with the applications. A short course arranged especially for those interested in the application of X-rays in medicine is outlined and discussed. In this course the fundamental principles in the production and measurement of X-rays are studied, both theoretically and experimentally. Modern developments in the physics of X-rays, such as X-ray spectra, are considered in connection with the problem of atomic structure. Particular subjects taken up include characteristics of tubes, electrical appliances, absorption coefficients, ionization effects, and emission and absorption spectra of X-rays.

72. C. R. BARDEEN, M.D., Madison, Wis.
"Radiology in the Medical Curriculum"

Abstract:—Radiology is a specialty. For the work of a specialist to be appreciated and effectively used it must, however, be understood in its broader aspects by men in other fields. For the work of the radiologist to be effective the family practitioner must be thoroughly familiar with the possibilities and limitations of radiology. The medical student should begin his familiarity with radiology during his study of anatomy and physiology. Both of these subjects are made more interesting through the application of radiology. With this as a basis, the medical student should be taught the chief application of radiology in the fields of diagnosis and therapy. The aim should be not to make the undergraduate medical student a specialist in this field but to prepare him in such a way that he

can, through co-operation with the specialist, make an intelligent use of this important field of medical science.

73. W. J. MEEK, M.D., Milwaukee, Wis.
"The Relation of Physiology to Roentgenology"

Abstract to be submitted later.

74. E. S. BLAINE, M.D., Chicago, Ill.
"The Essentials of the Teaching of Roentgenology to the Post-graduate Student"

Abstract to be submitted later.

75. PRESTON M. HICKEY, M.D., Ann Arbor, Mich.

"The Teaching of Roentgenology to Undergraduates"

Abstract to be submitted later.
General discussion.

Symposium on the Nasal Sinuses

Leader: A. GRANGER, M.D.,
New Orleans, La.

76. WILLIAM D. SANSUM, M.D., Santa Barbara, Calif.

"The Paranasal Sinuses as a Source of Focal Infection"

Abstract to be submitted later.

77. MARION E. BROWN, M.D., New Orleans, La.

"Ocular Manifestations of Diseases of the Paranasal Sinuses"

Abstract:—A survey of eyes in paranasal diseases by an ophthalmologist comprises a study of (1) color perception; (2) color acuity; (3) visual acuity; (4) campimetric observations of the blind spot; (5) peripheral field studies; (6) correction of refractive errors; (7) near point tests for muscle imbalance; (8) tangent screen studies for scotoma; (9) radiological studies.

The frontal sinus, with mucocoele, empyema and osteoma; the ethmoids with Meckel's ganglia syndrome as described by Schluder; the antrum with its manifold symptoms; the acute sphenoid with Van der Hoeve's sign and the sphenoidal syndrome; the behavior of colors both centrally and peripherally; the chronic type of Peter's contributions, then the hyperplastic type with varied symptoms complex are discussed and differentiated.

Lantern projections showing the peripheral fields and confirmative radiographs upon pa-

tients before and after surgical treatment demonstrating the recession of the color line, together with form, will be demonstrated; copies of fields from our record of the hyperplastic type of sphenoiditis will be distributed around for inspection. The new method for applying the color acuity test will be demonstrated.

78. H. J. ULLMANN, M.D., Santa Barbara, Calif.

"Roentgen Diagnosis of Nasal Sinus Disease"

Abstract to be submitted later.

79. J. R. HUME, M.D., New Orleans, La.
"Surgical Diagnosis of Paranasal Sinus Disease"

Abstract:—Purulent types of sinus diseases offer less difficulty of diagnosis than the hyperplastic types—the latter often present no physical signs as determined by the usual otolaryngological methods of examination.

The ophthalmological and radiological findings are necessary to determine the existing pathology in the hyperplastic types, and the surgical indications are often well outlined by the above findings.

Presentation of brief case history to illustrate the accuracy of such methods.

Thursday Evening, 7:30 P. M., Annual Banquet

FRIDAY, DECEMBER 3

Morning Session, 8 A. M.

80. R. B. KIRKLIN, M.D., Rochester, Minn.

"Newer Developments in Cholecystography"

Abstract to be submitted later.

81. SHERWOOD MOORE, M.D., St. Louis, Mo.

"Cholecystography"

Abstract to be submitted later.
Discussion.

82. FRANK BISSELL, M.D., Minneapolis, Minn.

"Rationale of Gall-bladder Diagnosis"

Abstract to be submitted later.

83. CHARLES G. SUTHERLAND, M.B. (Tor.), Rochester, Minn.

"Duodenal Ulcer; Comparison of Roentgenological and Histological Findings"

Abstract:—The author will present this subject, comparing the roentgenoscopic, surgical and histologic findings in a series of ulcers that have been excised in an attempt to establish the various factors concerned in the production of the deformities and irregularities of the duodenal contour, from which the roentgenoscopic diagnosis of duodenal ulcer is made.

Discussion opened by WILLIAM C. MACCARTY, M.D., Rochester, Minn.

84. S. C. BARROW, M.D., Shreveport, La.
"Roentgen Analysis of Bone Pathology"

Abstract:—1. Bone pathology depicted by X-ray more clearly than pathology of any other portion of the anatomy. 2. In most cases, in the light of present knowledge, the true condition can be determined. In others, the diagnosis can be brought within a limited few probabilities. 3. Most errors are caused by hasty conclusions, by not using information at hand. 4. Systematic use of information at hand imperative for correct interpretation. 5. Every condition that can exist in bone should be considered a probability until individually ruled out. 6. A reference chart of all bone conditions showing usual and characteristic X-ray findings should be at hand in all laboratories. Such a chart is here given.

85. E. L. JENKINSON, M.D., Chicago, Ill.
"Bone Tumors"

Abstract to be submitted later.

86. MAX KAHN, M.D., and L. C. COHN, M.D., Baltimore, Md.

"Discussion and Treatment of Bone Lesions of the Hand and Foot, with Special Reference to Bone Tumors"

Abstract to be submitted later.

87. M. A. BERNSTEIN, M.D., Chicago, Ill.
"Unusual Bone Lesions and Their Diagnoses (Cases of Epiphyseolysis)"

Abstract:—The paper deals with a condition often referred to as "Slipping Epiphysis of the Femur." The term, however, is inadequate, since the slipping of the epiphysis

is secondary to the pathology, whatever it may be. The author prefers to call these conditions epiphyseolysis. He will endeavor to link this pathologic disturbance with the well-known changes that occur in the head of the fifth metatarsal bone, known as Koehler's disease, changes in the scaphoid and in the os calcis. A great deal of work has been done in Italy by Professor Putti on epiphyseolysis occurring in the spine. A large number of cases has been collected. The author has had one case of this kind.

88. HENRY W. MEYERDING, M.D., Rochester, Minn.

"Discussion of Radiological Findings, Age, Sex, Incidence, Treatment and Possibility of Recurrence in a Review of a Group of Several Hundred Cases of Exostosis"

Abstract:—The author believes that the vast majority of cases of exostosis are readily diagnosed. The clinical history, findings and duration of the tumor are usually characteristic and experienced radiologists have very little difficulty in differential diagnosis. Exostoses may vary greatly, however, in their radiological appearance and in their location, and a review of a group of exostoses seen and diagnosed at the Mayo Clinic, considering the age and sex of the patient, the location of the tumor, its relativity to trauma, and the question of heredity is presented here. Special emphasis is placed upon the radiological findings and upon the differential diagnosis between exostoses and the more common forms of bone tumors.

89. WILLIAM C. MACCARTY, M.D., Rochester, Minn.

"Pathology of Bone Lesions"

Abstract to be submitted later.
Discussion.

FRIDAY, DECEMBER 3

Afternoon Session, 1:30 P. M.

90. H. P. MILLS, M.D., and W. W. WATKINS, M.D., Phoenix, Arizona.

"Localizing Foreign Bodies in or around the Globe"

Abstract:—When an eye is injured by a foreign body it immediately becomes of vital importance to determine (1) whether the globe was penetrated by the body, and (2) whether the foreign body remained in the globe or passed through it.

Localizing methods were very quickly developed after the discovery of the X-ray, and have enabled ophthalmologists to handle these injuries more skillfully and save eyes which would, otherwise, be lost. Foreign bodies can be very accurately localized with reference to the globe, and in many instances the character of the body can be determined by the density of the shadow.

Out of about 900 cases of eye injury examined, foreign bodies were localized within or immediately adjacent to the globe in 150 instances. These are tabulated.

91. ROBERT GLENN ALLISON, M.D., and KENNETH PHELPS, M. D., Minneapolis, Minn.

"Recognition of Non-opaque Foreign Bodies in the Air Passage"

Abstract:—1. Value and frequency of unilateral emphysema in foreign body in the bronchus. 2. Frequency and value of retained secretions in the bronchus. 3. Drowned lung. 4. Massive collapse of the lung. 5. Frequency of unilateral emphysema in foreign body in the trachea. 6. Disappearance of roentgen signs following removal of foreign body.

92. CHARLES F. BOWEN, M.D., Columbus, Ohio.

"Diagnosis and Removal of Foreign Bodies in the Bronchus and Esophagus"

Abstract to be submitted later.
Discussion.

Symposium on Radiographic Technic
Leader: LEWIS GREGORY COLE, M.D., New York City

93. P. D. BREWSTER, New York, N. Y.
"Photographic Principles that may be Applied to Roentgenography"

Abstract to be submitted later.

94. I. SETH HIRSCH, M.D., New York City, and C. T. ULREY, M.D., Bloomfield, N. J.

"New Types of Gas Tubes."

Abstract to be submitted later.

95. LEWIS GREGORY COLE, M.D., New York, N. Y.

"An Easy, Accurate and Practical

Method of Using the Gas Tube for all Routine Roentgenography."

Abstract to be submitted later.

96. H. CLYDE SNOOK, NEW YORK, N. Y.
"Characteristics of the Sine Wave and Their Effect on Roentgenography."

Abstract to be submitted later.

97. I. SETH HIRSCH, M.D., New York, N. Y.
"Roentgen Diagnosis of Primary Tumor of the Lung."

Abstract:—During the last ten years, as the result of the disclosures of the X-ray examination, the fallacy of the conclusion that primary cancer of the lung is a rare disease has been shown. Gross pathological changes responsible for the roentgen appearance. The X-ray findings are based on gross macroscopic changes dependent on the tumor and on the reaction of the lung tissue to it. Enumeration of the factors modifying the gross macroscopic appearance. The roentgenologist is entitled to a viewpoint regarding the value of clinical methods. Historical review of the advances in X-ray diagnosis of the diseases of the lung. The attitude of the clinician towards roentgenological diagnosis. Unjustified criticism by the clinician of the value of roentgen diagnosis of diseases of the lung. Physical signs *versus* roentgen signs. Analysis of the recent literature from the standpoint of the parts played by roentgen examination and physical signs in the diagnosis. The analysis of the X-ray findings in tumors of the lung. Differential diagnosis. Conclusions.

98. T. B. YOUNG, M.D., and A. L. COOPER, M.D., Scottsbluff, Nebr.
"A Study in Paleopathology"

Abstract:—As certain anatomical structures are primitive and fundamental, so certain pathological conditions have persisted from early geological periods to the present time. There is even less modification and variation in pathological conditions than in anatomical structure. Among these persistences are arthritides.

The material from the Pleistocene Period which has been preserved in the asphalt pits of Los Angeles may readily be examined both roentgenologically and microscopically and such studies are exhibited.

The particular points that the writers wish to develop in this paper and this exhibit are

the persistence of pathological conditions, grossly, microscopically and roentgenologically, over these long periods of geological time, as shown by their researches in comparative pathology.

Discussion.

99. I. S. TROSTLER, M.D., Chicago, Ill.
"Malpractice and Insurance Problems."

Abstract:—Insurance against malpractice suits is necessary. Malpractice suits are on the increase. Why so-called X-ray burn cases are the worst kind to defend and why X-ray workers have to pay more for insurance against malpractice suits indemnity than do other practitioners. Any one of us is liable to be sued, even without just cause. *No one is safe.* Mutual insurance among ourselves. Reciprocal insurance. Some results of the writer's investigation of one of the prominent reciprocals, and a general study of that kind of insurance. Reasons why reciprocals and mutual insurance organizations are undesirable. What insurance should prove. A suggestion looking toward a possible reduction of premiums or rates.

Discussion opened by R. H. STEVENS, M.D., Detroit, Mich.

FRIDAY, DECEMBER 3
 Evening Session, 8 P. M.

Public Health Symposium

Leader: M. J. HUBENY, M.D.,
 Chicago, Ill.

100. HERMAN BUNDESEN, M.D., Chicago, Ill.

"The Rôle of the X-ray in Public Health."

Abstract to be submitted later.

101. WESTON A. PRICE, D.D.S., Cleveland, Ohio.

"Dental Infections, Their Diagnosis and Prevention."

Abstract:—Two outstanding changes have occurred in our viewpoint regarding dental infections. The first is a change of emphasis from the importance of the specificity of the invading organism found in dental infections, to the importance of the specificity of the host or soil. The other is a recognition that structural changes in hard tissue about focal infections are the result of the activity of the defensive mechanism of the

host and hence an absence of this activity may be wrongly interpreted both with regard to quantity and importance of infection, for it is the individual who does not maintain a local quarantine about the focal infection who suffers systemically therefrom. This paper will be primarily a discussion of the significance of certain of the local expressions, and of the physical and clinical expressions of systemic involvements with which they may be related.

Since prevention is so much more to be desired than treatment or surgical interference, it is exceedingly important that susceptible individuals be anticipated, and overloads, including local primary focal infections, such as dental, be removed, in order to prevent the systemic involvements therefrom. The paper will accordingly review dental conditions which may be the important contributing factors to the injury of health, with an effort to differentiate between conditions which may and those which may not be diagnosed roentgenographically.

There are many opportunities for diagnosing from the roentgenograms evidence of infection where such does not exist. Some of these will be reviewed. The discussion will be primarily from the viewpoint of assisting the roentgenologist and the diagnostician in interpreting the significance of the presence or absence of data in roentgenograms of the teeth and their supporting structures.

102. W. D. COOLIDGE, Ph.D., Schenectady, N. Y.

"Cathode Rays Outside the Generating Tube."

Abstract:—Lenard, in 1894, succeeded in getting electrons from a cathode ray tube out through a thin metal window into the air. The voltage employed seems to have been about 30,000. The window consisted of a piece of aluminum foil 0.00265 mm. thick and 1.7 mm. in diameter.

A new form of Lenard tube is described, which has been operated with as much as 300.00 volts and several milliamperes. This tube has a nickel window 0.0127 mm. thick and 8 cm. in diameter, metallically connected to the glass envelope. It may be sealed off from the pump.

Various physical, chemical and physiological effects of the high voltage cathode rays are described.

Discussion.

SATURDAY, DECEMBER 4

Morning Session, 8 A. M.

103. LYELL C. KENNEY, M.D., and A. E. ELLIOTT, M.D., San Diego, Calif.
"Explosive Fractures of the Head of the Humerus."

Abstract to be submitted later.

Discussion.

104. JOHN D. CAMP, M.D., Boston, Mass.
"Radiation Therapy in Intracranial Lesions."

Symposium on Intracranial Lesions

Leader: G. W. GRIER, M.D.,
Pittsburgh, Pa.

105. L. E. DAVIS, M.D., Chicago, Ill.
(Surgical)
106. M. C. SOSMAN, M.D., Boston, Mass.
(Radiological)
107. FRANCIS C. GRANT, M.D., Philadelphia, Pa.
(Ventriculography)
108. H. L. POLLOCK, M.D., Chicago, Ill.
(Neurological)

Abstracts to be submitted later.
Discussion.

Clinical Thyroid Symposium

Leader: B. H. ORNDORFF, M.D.,
Chicago, Ill.

109. WILLIAM E. CHAMBERLAIN, M.D.,
San Francisco, Calif.

Title and abstract to be submitted later.

110. HENRY S. PLUMMER, M.D., Rochester, Minn.

Title and abstract to be submitted later.

111. A. J. CARLSON, M.D., Chicago, Ill.

Title and abstract to be submitted later.

112. FRANCIS B. SHELDON, M.D., Fresno, Calif.

"The Importance of Teeth in Routine Gastro-intestinal Examinations."

Abstract:—It has been found that alveolar infections are etiological factors in such diseases as arthritis, neuralgia, etc. It is conceivable that they may also be the cause of many of the abdominal symptoms and even of lesions of the gastro-intestinal tract.

Pus from the pyorrhea pocket mixes freely with the food during the process of mastication.

tion, and the toxins from apical abscesses may, through the blood stream, reach the intestinal tract as well as the joints. Of those patients who complain of abdominal symptoms and who have large fillings and old bridges, a very large percentage will be found to have alveolar infection, which, when

cleared up, will relieve the abdominal symptoms.

No doubt many times the persistence of symptoms after the surgeon has intervened can be traced to and relieved by the proper examination of the teeth and care of the infectious tract.

Discussion.

ABSTRACTS OF CURRENT LITERATURE

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Lung abscesses of experimental origin.—

The authors call attention to the fact that abscess of the lung has varying etiology, the same as abscess in other organs; that while 50 per cent of post-operative abscesses of the lung follow tonsillectomy, they are not due to the inspiration of infected material but rather to infective emboli. This has been fairly well proven by the numerous experiments in which infected material has been injected into the minute bronchi, no case producing true living abscess. By injecting infected material directly into the jugular vein, a general pneumonitis usually resulted, rather than an abscess. Using a small segment of a vein closed at each end and filled with infective organisms, abscess of the lung regularly followed its injection into the venous system. The theory is that by retaining the infective organisms in the lung tissue encapsulated, local resistance was established, resulting in a true walled-off circumscribed necrotic area.

The plan is unique and seems definitely to establish infective encapsulated emboli as the cause in most cases of lung abscess.

S. C. BARROW, M.D.

The Experimental Production of Abscess of the Lung. Elliott C. Cutler and S. A. Schlueter. Ann. Surg., August, 1926, p. 256.

Cancer of the skin.—Various forms of irritants, operating from without or from within, appear to be capable of producing cancer of the skin. In addition to these factors is an individual predisposition. Fortunately, in the vast majority of cases, cutaneous cancer does not tend to metastasize and the percentage of cures, therefore, is high.

W. W. WATKINS, M.D.

The Causes of Cancer of the Skin. J. F. Schamberg. Atlantic Med. Jour., March, 1926, p. 377.

Urinary leukoplakia.—This is an admirably arranged paper, reporting three cases and reviewing the literature. Speaking of the latter, the authors say: "Comparatively few case reports of this interesting and anomalous condition have appeared in American literature. Although Rokitsky published a paper on urinary leukoplakia as early as 1861 and other papers on the same subject appeared in foreign journals from time to time after that, it was as late as 1891 before A. T. Cabot reported a case of vesical leukoplakia, and his was the first report in American literature. Since then case reports and some reviews have been contributed."

Detailed reports are made of the authors' three cases, including the radiographic examinations. The cases on record are discussed under the headings of "Incidence," "Distribution," "Age," "Sex," "Bacteriology," "Pathogenesis," "Associated Pathology," "Symptomatology," "Passage of Membrane," "Diagnosis," "Treatment"—of both vesical and renal cases. This arrangement would seem to be of value to physicians who happen to meet only rarely a case of this disease. Case reports of the recorded cases follow, drawn from the literature, some eighty in all, condensed into four pages.

The authors reach the following conclusions:

"The condition is rare, but probably not so rare as the comparatively few case reports would indicate.

"If the urinary tract is considered as a whole, the condition occurs more often in men; so far, however, as concerns the kidney, men and women are affected in the same ratio.

"The renal pelvis is probably affected more often than the bladder, since there is little difference in the number of renal and bladder case reports, in spite of the fact that vesical leukoplakia can be diagnosed by cystoscopy alone, whereas the renal condition usually requires nephrectomy or necropsy for diagnosis.

"It may occur at any age. The average age at the time of diagnosis in the eighty cases was forty-one years. It occurred earlier in the renal cases. Since leukoplakia is a very chronic condition it is probably present years before diagnosis. In each of our three cases urinary symptoms had been present for thirteen years.

"Bacteriological data at the present time are not sufficient to justify any further conclusion than that infection of some type is usually associated with the lesion. In four cases, however, cultures of the urine were reported negative.

"The etiology is unknown. Irritation in the form of infection or stone, or both, is often present, but several cases have been reported in which no bacteria were discovered, and many in which there were no stones. While calculi, by irritation, may cause leukoplakia, we must not lose sight of the fact that desquamated cornified epithelium may act as a nucleus for stone, especially if infection is present.

"There is nothing pathognomonic in the symptomatology. The passage of pieces of membrane, however, should always suggest leukoplakia.

"Leukoplakia of the bladder does not respond to irrigations or instillations, so we must rely on resection, electrodesiccation, or radium, and none of these has been used often enough to allow us to judge its value."

Leukoplakia of the Urinary Tract: With Report of One Vesical and Two Renal Cases. W. T. Briggs and E. S. Maxwell. Jour. Urol., July, 1926, p. 1.

Rickets.—The author's summary is as follows: "As the result of laboratory and clinical investigations our interest now centers around the phosphorus ion in the study of the metabolism of rickets. A low phosphorus diet produces rickets in the rat; a low blood inorganic phosphate accompanies active rickets in the infant. Therapeutic measures raise the blood phosphate. Sunlight and ultra-violet light from artificial sources applied to the rat or the infant will cure or prevent rickets. Cod liver oil has a similar curative and preventive action. Inert substances, such as linseed and cottonseed oils, have been rendered active anti-rachitic agents after irradiation with ultra-violet light. The factor in cod liver oil and irradiated oils that is responsible for the cure of rickets is separate and distinct from the fat-soluble A vitamin."

W. W. WATKINS, M.D.

Recent Phases of the Rickets Problem. L. Von Meysenbug. *Sou. Med. Jour.*, July, 1926, p. 522.

Red rays.—The author has studied the therapeutic possibilities of the red rays in view of the beneficial results of sunlight on the muscles of persons suffering from tuberculous arthritis. Owing to the absorption of other rays by the water content of the tissues and the blood, red rays alone produce direct effects on the deeper tissues. The red rays are found to be absorbed by muscles and by inflammatory exudates. Cases of acute anterior poliomyelitis were investigated, in some of which the muscles showed complete degeneration reactions and no contraction could be obtained by the interrupted galvanic current. While the red rays were being administered special measures were also taken to preserve the nutrition and to prevent stretching of the paralyzed muscles.

Carbon filament vacuum lamps were used because they yielded light richer in red rays and infra-red frequencies than metal filament lamps in gas-filled globes. Red-stained soda glass screens were interposed in order that the maximum intensity of red rays might be used without overheating the skin; a reflector was used to direct the rays, the lamp was placed at

a distance of two feet from the part affected, and daily exposures were given. In four children who had had anterior poliomyelitis, and in two patients with tuberculosis of the leg and knee, encouraging results were obtained, and chronic ulcers healed rapidly; the treatment is also recommended for lupus and acute inflammations. The author believes that irradiation with red rays produces in the deep tissues an increased power of resistance and repair and an improved nutrition.

Therapeutic Value of Red Rays. G. M. Levick. *Brit. Jour. Radiol.*, May, 1926, p. 185. (Reprinted by permission from *Brit. Med. Jour.*, July 17, 1926, p. 11 of *Epitome of Current Medical Literature.*)

Radium in the treatment of leukemia.

Thirty cases of myelogenous leukemia observed during the last twelve years, two-thirds of which had been treated before with roentgen rays without success, are reported by the author. No definite rule as to the single dose administered is given. He used radium element, filtered through 1.5 mm. lead and 4 mm. wood. The total dose in one of these treatment series varies considerably (from 6,000 to 31,000 milligram hours): it is decided in each individual case, based upon clinical and blood findings. Details of the thirty case records must be looked up in the original.

E. A. POHLE, M.D.

Observations during 1912 to 1924 of the Radium Treatment of Thirty Cases of Chronic Leukemia. F. Dautwitz. *Strahlentherapie*, 1926, XXIII, 107.

Hard and soft roentgen rays in the treatment of skin cancer.

—The author has continued his research as to the effect of roentgen rays on mitosis and its practical value for selecting the right interval in the fractional dose method (see RADIOLOGY, 1926, VI, 76). He irradiated in a special treatment phantom a small ionization chamber which was connected to a Siemens dosimeter. Close to the chamber the larvæ of salamanders were placed; the same ionometrically defined dose was given.

in one case with 100 K.V. through 1.0 aluminum, in the second series with 200 K.V. through 1.0 copper. Histological studies of the cornea of the larvæ revealed identical changes; the different wave lengths of the two qualities of radiation used in the experiments had no influence on the biological effect. The author suggests, therefore, treating a skin carcinoma first with hard rays which penetrate to the deeper layers and also reach the surrounding tissue without causing a severe reaction, to be followed by a treatment of the tumor only with soft radiation.

E. A. POHLE, M.D.

The Problem of the Biological Effect of Hard and Soft Rays in its Relation to Roentgen Therapy of the Skin Carcinoma. W. Alberti. Strahlentherapie, 1926, XXIII, 31.

Epithelioma of the skin.—Cancer of the skin is curable in practically all cases if treated skillfully and thoroughly, before it has involved the deeper tissues. The first essential is the accurate determination of the extent of the disease. The three agents advised are radium, X-rays and electrocoagulation; each has its place and frequently two or three can be combined to advantage in the same case.

For epithelioma about the eyelids radium will serve best, as its biologic effect is about three times as great as X-rays for a given amount of radiation delivered into the tissues. Lesions about the face are usually in the precancerous stage and if treated early, thoroughly and skillfully, results are excellent. Moles should be destroyed by electrodesiccation done with skill and thoroughness. Papillary epitheliomas can be more certainly cured by electrocoagulation, followed by radium and X-ray. For lesions which have extended into the deeper tissues, the treatment, of course, is more difficult and results more uncertain.

Epitheliomas about the temporal region and ear are frequently squamous cell, with a graver prognosis. The lesion should be thoroughly destroyed by electrocoagulation, followed by heavily filtered X-rays or gamma radiation over the neighboring lymphatics.

Of epitheliomas of the lip, seen early and strictly localized, practically all can be cured. The author's records show a cure of approximately 90 per cent of these lesions, if treated before there are palpable lymph nodes.

The technic of using these agents requires as great skill, judgment and care as any surgical operation.

W. W. WATKINS, M.D.

The Treatment of Epithelioma of the Skin. G. E. Pfahler. Atlantic Med. Jour., March, 1926, p. 381.

Challenging statistics.—This is a statistical report on 573 cases of malignant disease observed over a period of twelve years (1913-1925), 437 operated on, 136 not operated on. Of the 437 cases operated on, the known living number 73, or 0.167, and 9 of these have evidence of disease—a net cure of 0.143. Of the 136 cases not operated on, 12, or 0.088, are still living. Deducting this from 0.143 leaves a net result of 0.055 still living and well to be credited to operative interference. Of the 64 cases living and free of disease, only 13 have passed the five-year period.

The article and its accompanying tables should be studied carefully by all interested in the treatment of malignant disease, as it is, in fact, a record of unaided surgery, as the author states that radiation was used in only a few cases where the operative outlook was poor.

The writer says he can make no definite statement as to results of radiation, but his personal impression is that it has nothing more than a moral effect. This is rather confusing to those who are viewing the problem from every angle, as recent reports from the Memorial Hospital show five-year cures in cancer of the breast by surgery to be 24 per cent, surgery and radiation 38 per cent, radiation, surgery and radiation 52 per cent.

The third paragraph of the article which says that, "No sadder report of the disheartening status of cancer surgery has come to our attention; it is, however, inevitable, dealing only with facts," should have been written last. The writer is to be commended for his

frankness. The article should be studied by all who attempt the treatment of malignant disease, and his parting suggestion, "We think it is about time the partisans of radiotherapy published a study of results along the lines of this paper," should be taken to heart.

S. C. BARROW, M.D.

Final Results in the Surgery of Malignant Disease: Study of a Twelve-year Follow-up. Charles L. Gibson. *Ann. Surg.*, August, 1926, p. 158.

Lesions of bone.—This study now includes practically 1,000 cases. The predominant lesions are benign bone cysts (lesions of the shaft in children), the benign giant-cell tumors (involving the epiphysis in adults), and sarcomas. The bone lesions nowadays are seen much earlier than formerly, and the X-ray characteristics are, therefore, somewhat different.

A central bone tumor in the shaft of a patient under fifteen years is almost certainly a bone cyst; if the patient is an adult it is more likely to be a chondroma or a metastatic tumor. When the epiphysis is involved it is usually a giant-cell tumor, with rarer cases of chondroma, myxoma, metastatic tumor, or myeloma. Brodie's abscess in the shaft differs little from a cyst. Therefore, a central bone lesion with intact bone shell does not call for amputation but conservative operation. Introduction of radium into bone cavities is not advised.

Of the periosteal bone lesions, sarcoma in its varying picture is most frequent. The sclerosing sarcoma is the most distinctive; even in the earliest X-rays there is an irregular cloud over the shaft of the bone, with a distinctly visible soft part shadow in the periosteal zone. In the osteoporotic sarcoma the onset is usually in the shaft near the epiphysis, the bone being more porous, the picture being almost identical with the osteoporosis of non-use, with a thin, faint periosteal shadow. The excessively ossifying sarcoma is probably a late stage of the sclerosing sarcoma, and the destructive sarcoma is probably the late stage

of the osteoporotic sarcoma. The periosteal sarcoma is still recognized though we know that the shaft is usually involved; however, there is a periosteal sarcoma resting on the shaft replacing the periosteum, in which the X-ray can show no bone changes.

Of the benign periosteal lesions, the exostosis is distinguished by the normal cortical bone beneath the new bone formation. In ossifying periostitis from trauma or infection, the cortical bone may be involved, and the marrow shadow may not be distinct, so that the picture may be difficult to separate from sarcoma.

The order of frequency of the periosteal tumors is: osteoma, including exostosis and ossifying periostitis; chondroma, or osteochondroma, and myxoma.

Sarcoma may begin like an osteomyelitis, with intense pain, rapid swelling and fever, but without leukocytosis.

The other inflammatory lesions of bone, including chronic osteomyelitis, tuberculosis, syphilitic periostitis or osteomyelitis, can usually be differentiated by the history and by X-ray findings.

W. W. WATKINS, M.D.

A Brief Summary of Benign and Malignant Lesions of Bone. Joseph Colt Bloodgood. *Sou. Med. Jour.*, July, 1926, p. 541.

Injection of the kidney pelvis under the fluoroscope.—The author, collaborating with Dr. F. B. Sheldon, has withdrawn the catheter under direct observation in 200 cases, and bases the present paper on information obtained by the practice of this method. He believes that heretofore not sufficient emphasis has been placed upon the advantage of the use of the fluoroscope in this connection, since it will eliminate many uncertainties as well as add a factor of safety. Normal, unusual, and infected conditions are illustrated by pyelograms. The author concludes: "In my own experience I have felt a greater accuracy is maintained by injecting the kidney under observation, and as I have observed the flow

down the ureter while the injection proceeded the fear of over-distending these delicate structures has been modified. The mobility of the kidney is easily ascertained, the change from the normal action observed, and when stones that have never been suspected are encountered, turning the patient as the filling is in progress will give valuable information that will assist when reading the plates. In this work the trained eye of the roentgenologist has been of invaluable assistance, as he is daily making observations of the chest and abdomen. He has called my attention to many facts which have escaped notice or which were not appreciated when first observed."

The Fluoroscope as an Aid to Making Pyelograms. W. W. Cross. *Jour. Urol.*, July, 1926, p. 37.

Carcinoma of the esophagus.—Routine of examination in suspected cases is to take a careful clinical history, make a complete physical examination, an X-ray examination by fluoroscopy and film study of the esophagus and gastro-intestinal tract, an esophagoscopy examination and passage of guided bougies. All are necessary if one is to arrive at a correct diagnosis.

Malignant stricture is rarely found in persons under thirty-five years of age; 80 per cent occur in males; the early symptoms are very vague, and if indefinite symptoms are not given serious consideration early diagnosis will fail. X-ray should follow the clinical history and physical examination, and should be directed first toward ascertaining the presence of extrinsic lesions producing esophageal symptoms, such as aneurysm of the arch or mediastinal tumors. For the esophageal lesions a thick barium mixture will usually outline the involved area. The examination should always include the stomach. Esophagoscopy is essential if the very early curable lesions are to be detected. Bougies should not be passed blindly, but always guided over a thread previously swallowed so that one end is anchored in the intestine. The X-ray may fail to disclose the extent of the lesion below

the point of stricture, and bougies are necessary for this purpose.

At the present time the outlook for carcinoma of the esophagus is hopeless; improvement in prognosis must come from early diagnosis and development of surgical measures.

W. W. WATKINS, M.D.

The Diagnosis of Carcinoma of the Esophagus and a Short Discussion of its Treatment. E. B. Freeman and H. E. Wright. *Sou. Med. Jour.*, July, 1926, p. 508.

Symptoms and demonstration of diaphragmatic hernia.—The purpose of this paper is to make physicians familiar with signs and symptoms. The symptomatology is usually that of epigastric distress, acidity, regurgitation and vomiting. Patients complain of fullness in the chest after a regular meal, or when lying down. Distress is relieved by vomiting. Many find relief in taking alkalies, but are made worse by taking food,—an aid in differential diagnosis from ulcer. Dyspnea is often a prominent symptom. Intestinal obstruction may be a symptom.

Physical findings:—Tympanic percussion note, distant breath sounds, gurgling and tinkling sounds over lower chest, with hyper-resonance over upper chest.

Balfour gives three important diagnostic points: "(1) Destruction of the definite dome shape characteristic of normal diaphragm. (2) Appearance of lung tissue shadow seen through gastric gas bubble when formed in the chest. (3) Demonstration of barium in the colon when found above the bow line of the diaphragm."

Abbott's technic for demonstrating small hernia.—The opaque meal given to patient while standing does not reveal the hernia, but if the patient is placed on the back and instructed to take a deep breath, hold it and strain, the stomach is forced into the sac, also the liver is pushed down, affording a better view. "The patient is then turned to his right, which brings the opaque solution into more intimate contact with the esophageal opening." The turning is continued until the patient lies on his abdomen, with deep breathing and

straining at intervals. Hernia shadow should appear rounded above the diaphragm.

Treatment is surgical and the approach may be through either abdomen or chest.

C. H. DEWITT, M.D.

Diaphragmatic Hernia. John W. Dreyer. Ill. Med. Jour., July, 1926, p. 47.

Back scattering in roentgen therapy.—

Further measurements of the amount of back scattering in roentgen radiation are reported in this paper. Using the Martius ionometer, the intensity to be added to the primary radiation (192 K.V., 4 ma., 50 cm. F.D., 1.0 zinc plus 1.0 aluminum) reaching the surface was found for various fields, as follows:

Size of field	Back scattering intensity
15 × 20 cm.	42.8%
10 × 15 cm.	41.5%
10 cm. diameter	31.3%
6 × 8 cm.	30.4%
5 cm. diameter	24.2%
3 cm. diameter	21.6%

The same series were carried through with one and two tubes connected to the same transformer. In the latter case, an energy loss of from 10 per cent (large field) to 28 per cent (smallest field) is noted. A comparison between these figures taken on the inductor apparatus with a storage battery or an inductor feeding the filament circuit showed 100 per cent difference in the back scattering on large fields. This discrepancy is explained by the deformation of the secondary potential and current curves. Measuring the amount of back scattering for each individual apparatus is suggested in order to get comparable material necessary for the definition of an average erythema dose in roentgen units.

E. A. POHLE, M.D.

What Is the Amount of Back Scattering? K. Breitlander. Strahlentherapie, 1926, XXIII, 79.

Effect of roentgen rays on bacteria.—This investigation deals with the influence of the

medium or the X-ray effect upon bacteria. The radiation used in these treatments had an average wave length of 1.47 Ångströms (70 K.V., 9 ma., 7.5 F.D., no filter, tube with Lindemann window). The dose varied between 58,000 and 407,000 roentgen units. It appeared that bacteria outside of their medium showed the maximum effect; in agar culture fresh growing germs were much more sensitive than those twenty-four hours old.

E. A. POHLE, M.D.

The Effect of Roentgen Rays on Unicellular Living Organisms. G. H. Klovekorn and O. Gaertner. Strahlentherapie, 1926, XXIII, 148.

Primary carcinoma of the lung.—This is still spoken of as a rare lesion, though statistics show it to be relatively common. The authors report 21 cases found at necropsy and three proven by biopsy. The involvement may be (1) infiltrating, (2) multiple nodular, (3) solitary nodular, (4) miliary, or (5) mixed. In eight of the cases cited, involvement was confined to a single lobe, while it extended into all lobes of one lung in three. In two cases, there was a single nodule deeply buried in the tissues of the lung surrounded by a few miliary nodules.

The consensus of opinion is that the majority of these tumors arise from the bronchial epithelium, and only a few from the parenchymal or alveolar epithelium.

One of the prime requisites to diagnosis is to keep in mind the possible presence of the lesion. In a patient of middle age or past, with unilateral findings of an area of dullness or flatness, associated with decreased or absent breath sounds, with pain in the chest, with or without dyspnea, one should suspect neoplasm. X-ray may or may not be of value in diagnosis, depending on the conditions in the chest. If there is fluid or associated inflammatory lesions, the shadows may not be characteristic. In three of this series, diagnosis was made by X-ray. The conditions most confusing are interlobar effusions, encysted empyemas, pneumoconiosis, bronchiec-

tasis, lobar pneumonia and mediastinal new-growths.

Deep roentgen-ray and radium treatments have been used in treatment, but with little benefit.

Case reports of the twenty-four cases are given.

W. W. WATKINS, M.D.

Primary Carcinoma of the Lung: a Clinical and Pathological Study from the Cook County Hospital, with a Report of 21 Necropsies and 3 Biopsies. J. S. Grove and S. E. Kramer. *Am. Jour. Med. Sci.*, February, 1926, p. 250.

Functional changes of the blood vessels after roentgen exposure.—The effect of roentgen rays on small blood vessels has been studied by the authors; in the first part of the work which is related in this paper, they employed pharmacological methods on the isolated ears of rabbits (adrenalin, chloral-hydrate, caffeine reaction). One ear of a rabbit was irradiated *in vivo*, and the animals used in the experiments were killed from five minutes to two months afterwards. Both ears of each animal were isolated and examined. It appeared that the vasodilating apparatus was more irritable; this could be observed twenty-four hours after the exposure. Small

doses which did not cause hyperemia or epilation disturbed only the vasodilatory function for three weeks; after heavy doses this effect was present for two months until the skin effect appeared. At this time, the vasoconstrictors showed marked decrease in response to stimuli.

E. A. POHLE, M.D.

Regarding the Functional Changes of the Blood Vessels after Roentgen Radiation. I. Pharmacodynamic Investigation of the Functional Stage of Blood Vessels in the Isolated Ears of Rabbits after Previous Radiation in vivo. N. W. Lazarew and A. Lazarewa. *Strahlentherapie*, 1926, XXIII, 41.

Automatic filter and time selector.—Description of an automatic filter and time control which can be built into the circuit of an X-ray therapy machine; the device is based on a system of electromagnets and can be compared with the dial telephone method.

E. A. POHLE, M.D.

Combined Safety Device on Roentgen Apparatus with a Combined Filter and Time Selector. F. Irle and W. Bergerhoff. *Strahlentherapie*, 1926, XXIII, 181.

